Expert Rebuttal Report of Anindya Ghose, Ph.D.

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THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

STATE OF ARIZONA, *ex rel.* MARK BRNOVICH, Attorney General, Plaintiff, v. GOOGLE LLC, A Delaware Limited Liability Company, Defendant.	Case No. CV2020-006219

EXPERT REBUTTAL REPORT OF ANINDYA GHOSE, PH.D.

June 8, 2022

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I. INTRODUCTION

A. Qualifications

1. I am the Heinz Riehl Chair Professor of Business at New York University's Leonard Stern School of Business, where I hold joint appointments as Professor of Technology, Operations, and Statistics and Professor of Marketing. I also serve as the Academic Director of the Masters of Business Analytics program at NYU Stern. At NYU, I have served in a number of capacities, including Director of the Center for Business Analytics, Co-Director of the Center for Digital Economy Research, Co-Director of the Masters of Science in Business Analytics Capstone, and Co-Chair of the NYU-AIG Partnership on Innovation for Global Resilience. I have both an MS and Ph.D. degree from Carnegie Mellon University.

2. The principal focus of my research and teaching at NYU has been analyzing the economic consequences of the internet and mobile technologies on industries, firms, and markets transformed by their shared technology infrastructure. I have worked on economic issues arising in digital platforms, online markets, internet commerce, digital marketing, digital advertising, mobile advertising, crowdfunding, and social media, among other topics. I have published more than 100 papers in premier scientific journals and peer-reviewed conferences, including work that has analyzed user behavior with respect to data privacy issues in the digital and mobile economies. I have also co-authored more than 100 workshop articles. I have received 25 Best Paper awards and nominations for excellence in research in Information Systems, Computer Science, and Marketing from various journals, conferences, and workshops.

3. My book TAP: Unlocking the Mobile Economy is a double-winner in the 2018 Axiom Business Book awards, with the Gold award in the Business Technology category and the Bronze award in the Economics category. It illustrates how firms can leverage the highly granular, consumer-level data that is being generated from smartphones and digital technologies to create targeted offers and discusses the behaviors demonstrated by consumers with respect to data privacy issues. The book has been translated into five languages so far. My research and opinions have been profiled numerous times in the U.S. and international media.

4. I am currently the Department Editor of Management Science for Information Systems. In the past I have served as a Senior Editor of Information Systems Research and Associate Editor of Management Science. I am a winner of the National Science Foundation's ("NSF") CAREER award, their most prestigious award in support of junior faculty who "have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization." I have

received grants from the NSF, Google, Microsoft, Adobe, Marketing Science Institute, Wharton Customer Analytics Institute, and the Networks, Electronic Commerce, and Telecommunications Institute in recognition of my research.

5. I have received numerous awards, honors and recognitions. I am a recipient of the INFORMS Information Systems Society ("ISS") Distinguished Fellow Award, which recognizes individuals who (i) have made outstanding intellectual contributions to the discipline with publications that have made a significant impact on theory, research, and practice; and (ii) contributed to the intellectual stewardship of the field as reflected in the mentoring of doctoral students and young researchers. In 2014, I was named by Poets & Quants as one of the Top 40 Professors Under 40 Worldwide. In 2017, Thinkers50, the premier ranking of global business thinkers, recognized me as one of the top management thinkers most likely to shape the future of how organizations are managed and led. In 2019, I was recognized by the Web of Science citation index in the top one percent of researchers selected for their significant influence in their fields. In 2020, I was recognized by the INFORMS ISS with the inaugural Practical Impacts Award. This award honors business school academics who have demonstrated outstanding leadership and sustained impact on the industry by deeply influencing practitioners, managers, executives, and policy makers using their academic research.

6. I have consulted in various capacities for many leading firms on realizing business value from information technology ("IT") investments, internet marketing, business analytics, data science, mobile marketing, digital platforms, social media, and other areas. I serve or have served as an advisor to several start-ups in the internet and mobile space across the U.S., India, China, South Korea, Singapore, the U.A.E, the Netherlands, and the U.K., and am on the advisory board of several of these companies. I have also conducted academic research in collaboration with many leading companies and have co-authored research papers using these companies' data. I am also an advisor to venture capital funds in the U.S.

7. I have taught courses on the role of IT in business and society, internet commerce, social media, digital marketing, and business analytics at the undergraduate, MBA, Executive MBA, Masters of Science in Business Analytics, Executive Education, and Ph.D. levels worldwide. Many of these courses involve taking a deep dive into the economics of mobile apps and various other aspects of the mobile economy. In 2019, I won the NYU Stern school-wide "Distinguished Teaching" award.

8. I have also served as an expert witness for IT and consumer-related litigation and have provided expert testimony in multiple trials and depositions. A copy of my curriculum vitae and a list of my testimony in the past four years are attached as Appendix A.

9. I am being compensated for my work in this matter at my current hourly rate which is $975. Professional staff members at Compass Lexecon also performed support work for me under my direction. In addition, I receive compensation based on a proportion of Compass Lexecon billings. Neither my fees nor those of Compass Lexecon are contingent upon the conclusions I reach or on the outcome of this matter. I reserve the right to revise my opinions should additional evidence become available to me. A list of all materials considered in this report is attached as Appendix B.

B. Assignment

10. Jennifer King, Ph.D., Colin M. Gray, Ph.D., and Daniel S. Levy, Ph.D. submitted reports on behalf of counsel for the State of Arizona, dated May 4, 2022. Dr. King was "asked to consider whether and how the conduct alleged here relates to consumer harm, and to assist the factfinder considering that issue."[1] Dr. Gray was "asked to apply [his] experience in recognizing and analyzing dark patterns as part of this analysis," and to "determine whether Google employs 'dark patterns' and, if so, to characterize and explain certain instances of 'dark patterns' that relate to location tracking."[2] Dr. Levy was "asked to assess and provide certain opinions concerning two types of remedies: disgorgement, and civil penalties."[3] I have been asked by counsel for Google to review and, if appropriate, respond to certain opinions of Dr. King, Dr. Gray, and to a certain opinion of Dr. Levy from the basis of my background and my review of available evidence and academic or practitioner literature. I have focused my opinions in most cases to conceptual issues and have not attempted to evaluate every specific claim made by Dr. King, Dr. Gray, and Dr. Levy. That one or more of their claims is not explicitly addressed here should not be construed to imply that I agree with those claims.

11. My work on this matter is ongoing, and I reserve the right to update my opinions as additional information becomes available.

C. Relevant case facts

12. In its Complaint, Plaintiff asserts that Google has engaged in deception in connection with sales of its products and services, including smartphones, apps, and advertisements.[4] Plaintiff accuses Google of

[1] Expert Report of Jennifer King, Ph.D., May 4, 2022, ("King Report"), p. 3.
[2] Expert Report of Colin M. Gray, Ph.D., May 4, 2022, ("Gray Report"), p. 1.
[3] Expert Report of Daniel S. Levy, Ph.D., May 4, 2022, ("Levy Report"), p. 3.
[4] Complaint for Injunctive and Other Relief, S*tate of Arizona, ex rel. Mark Brnovich, Attorney General v. Google LLC, a Delaware Limited Liability Company,* The Superior Court of the State of Arizona in and for the County of Maricopa, May 27, 2020, ("Complaint"), ¶¶ 23, 159-160.

misleading consumers about how and when it collects location information from specific settings and related services—Location History ("LH"), Location Reporting, Location Sharing, Web & App Activity ("WAA"), Supplemental WAA ("sWAA"), WiFi, WiFi Scanning, Bluetooth Scanning, Device Location, Google Location Accuracy, app-level permissions, and Ad Personalization—and of profiting from this information by using it to provide ad services.[5] I understand from counsel that, currently, the outstanding issues are: (1) whether Google has engaged in any deceptive conduct; and (2) whether any such deceptive conduct was "in connection with" the "sale or advertisement" of apps or smartphones.

D. Summary of conclusions

13. My principal conclusions are as follows:

    a. Drs. Gray and King ignore several key factors relevant to their conclusions including: user heterogeneity in privacy choices and preferences, the difficulty in accurately gauging users' willingness to share their personal data, user benefits from location-based services, and user value from location-based advertising.

    b. Dr. King's conclusions regarding "Harms from Location Data Tracking" are unsupported by scientific methods and some of them are not tied to alleged conduct at issue in this case.

        i. Dr. King's own academic papers have used established scientific methods and her conclusions in this matter require use of scientific methods. In the absence of these scientific methods, her conclusions here rely solely on anecdotes, untested hypotheticals, and academic studies that do not reliably support her conclusions.

        ii. Dr. King's report also fails to establish that Google intended to deceive or harm users as alleged or that the alleged deception or harm occurred in connection with a sale or advertisement to Arizona users.

    c. Dr. Gray's conclusions that "Google's Internal Documents Show That Google Has Been on Notice for Many Years That Its Settings Are Confusing and Deceptive to Users," that "Google's UI and Related Location Collecting Practices Contain Specific Dark Patterns," and that "Google's Use of Dark Patterns" is connected to "Business Goals" are unsupported by scientific methods. I am not opining on whether Google's UI and location collection practices evidence "dark patterns," which I understand from counsel another expert, Dr. Donna L.

[5] Complaint, ¶¶ 8-9, 38, 161.

Hoffman, is addressing. I am opining on Dr. Gray's lack of a scientific methodology to support his conclusions that Google's UI and related location collecting practices contain specific "dark patterns."

i. Dr. Gray's own academic papers purport to use systematic data collection and empirical analysis. So do some other researchers in the same field but they caution that the current "dark patterns" literature relies on a shaky foundation for which these methods cannot solve. Dr. Gray did not conduct such a scientific study or systematic research for the current matter. Instead, his conclusions rest on cherry-picked evidence and his own subjective judgment.

ii. Dr. Gray's report also fails to establish that users were deceived as alleged, that Google intended to deceive users as alleged, or that the alleged deception occurred in connection with a sale or advertisement.

d. Dr. Levy does not provide economic or financial basis for "harm to the public" as a factor relating to assessment of the "amount of penalties that should be imposed per violation." Any such analysis must include the consumer benefits of location-based services (LBS) and geotargeted advertising to be reliable.

II. DRS. GRAY, KING, AND LEVY IGNORE SEVERAL FACTORS REGARDING USER HETEROGENEITY IN PRIVACY CHOICES AND PREFERENCES, USER BENEFITS FROM LOCATION-BASED SERVICES, AND VALUE FROM LOCATION-BASED ADVERTISING

A. Users are heterogeneous in their concerns about privacy

14. Developing a privacy policy for a company like Google is a complex task that requires navigating the competing needs and preferences of millions of users. One critical aspect of this process is accounting for the fact that users differ substantially in how concerned they are about sharing their information, while a privacy policy is typically applied consistently and must cater to all users. Privacy research nomenclature traditionally identifies consumers as (i) "privacy fundamentalists," who "reject[] consumer-benefit or societal-protection claims for data uses and sought legal-regulatory privacy measures;" (ii) "privacy unconcerned," who are "generally ready to supply their personal information to business and government" and reject too much "privacy fuss;" or (iii) "privacy pragmatists," who "examine[] the benefits to them or society of the data collection and use, want[] to know the privacy risks and how

organizations proposed to control those, and then decide[] whether to trust the organization or seek legal oversight."[6]

15. The strictest of these three categories, privacy fundamentalists, is typically understood to constitute a minority of consumers, with the vast majority willing to share at least some personal information and data for a more meaningful engagement with the product or other value. The first studies of privacy fundamentalism in the 1990s found that this segment constituted approximately 25% of consumers in most surveys.[7] Recent studies focusing on online behavior indicate similar or lower representation of privacy fundamentalists.[8] For instance:

a. A 2021 survey of 2,038 U.S. respondents estimated that privacy fundamentalists represent "21% of the US population (down from 24% in 2017)," pragmatists are 48% (down from 58%), and unconcerned are 31% (up from 18% in 2017).[9] That is, on the net, both pragmatists and fundamentalists are moving into the unconcerned category.

b. The 2017 version of the survey also found that "76% of respondents agree that they should be able to trade their data for better offers and services."[10]

c. In a paper published in 2019, my co-authors and I offered visitors to a major shopping mall the option of getting personalized mobile offers if they were to accept the offer to sign on to the free WiFi system and share their location information.[11] Approximately 80% of mall visitors accepted the offer.[12]

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[6] Alan F. Westin (2003) "Social and Political Dimensions of Privacy," *Journal of Social Issues*, 59(2):431-453, https://doi.org/10.1111/1540-4560.00072, p. 445.

[7] For example, 1990, 1996, 2000, and 2003 studies found privacy fundamentalists constituting either 25% or 26% of consumers, and 2001 study finding privacy fundamentalists constituting 34% of consumers; 1990, 1996, 2000, 2001, and 2003 studies found privacy pragmatists constituting 55% to 64% of consumers and privacy unconcerned constituting 8% to 18% of consumers. Ponnurangam Kumaraguru and Lorrie Faith Cranor (2005) "Privacy Indexes: A Survey of Westin's Studies," *Software Research International*, *Carnegie Mellon University*, http://reports-archive.adm.cs.cmu.edu/anon/anon/home/ftp/usr0/ftp/isri2005/CMU-ISRI-05-138.pdf, p. 17-18.

[8] It is useful to note that given the "privacy paradox" phenomenon discussed in **Section II.B** below, these survey estimates are likely to be inaccurate.

[9] Global Data and Marketing Alliance (2022) "US Data Privacy: What the Consumer Really Thinks," https://globaldma.com/wp-content/uploads/2022/03/GDMA-US-Data-Privacy-2022.pdf, ("Global Data and Marketing Alliance (2022)"), p. 6. While the results were published in 2022, the methodology section explains that the survey was conducted in December 2021. Global Data and Marketing Alliance (2022), p. 29. Similarly, the earlier study was published in 2018, but the data were collected in 2017; Data & Marketing Association and Acxiom (2018) "Data privacy: What the consumer really thinks," https://marketing.acxiom.com/rs/982-LRE-196/images/DMA-REP-DataPrivacy-US.pdf, ("Data & Marketing Association and Acxiom (2018)"), pp. 6, 18.

[10] Data & Marketing Association and Acxiom (2018), p. 4. It appears that the question was not asked in 2021.

[11] Anindya Ghose, Beibei Li, and Siyuan Liu (2019) "Mobile Targeting Using Customer Trajectory Patterns," *Management Science*, 65(11):5027-5049, https://doi.org/10.1287/mnsc.2018.3188, ("Ghose et al. (2019a)").

[12] Ghose et al. (2019a), p. 5046.

d. A 2016 academic study concluded that only about 15% of U.S. online shoppers are privacy fundamentalists.[13]

16. Even excluding privacy fundamentalists, the willingness to share data varies across demographic categories. For instance, practitioners have recognized that younger consumers are typically more willing to share personal data online,[14] and this finding is consistent with survey data showing that younger generations feel more comfortable with a company handling their personal data.[15] The 2021 survey of 2,038 U.S. adults mentioned above found that the percent of privacy fundamentalists is between 8% and 14% for age groups 18-24, 25-34, and 35-44 and between 19% and 41% for age groups 45-54, 55-64, and 65+.[16]

17. Compounding this heterogeneity, users' willingness to share personal data can change over time and depend on context. As one survey of the literature explains, "[t]he way we construe and negotiate public and private spheres is context-dependent because the boundaries between the two are murky: The rules people follow for managing privacy vary by situation, are learned over time, and are based on cultural, motivational, and purely situational criteria."[17] Others have also shown that the willingness of users to share data also varies by the type of data and context.[18] Trusting the organization is a top reason for making one "happy to share [...] personal information with a company."[19] Online surveys of U.S. respondents conducted in 2017 and 2021, discussed above, found that online privacy concerns have fallen from 82% to 69%, comfortability with personal data collection has increased from 44% to 51%, valuing

[13] Tun-Min (Catherine) Jai and Nancy J. King (2016) "Privacy versus reward: Do loyalty programs increase consumers' willingness to share personal information with third-party advertisers and data brokers?" *Journal of Retailing and Consumer Services*, 28:296-303, http://dx.doi.org/10.1016/j.jretconser.2015.01.005, p. 302.
[14] Lauren Johnson (2016) "Digital-Savvy Millennial Will Sacrifice Privacy for Personalization, Says Leo Burnett Exec," *AdWeek*, https://www.adweek.com/performance-marketing/digital-savvy-millennials-will-sacrifice-privacy-personalization-says-leo-burnett-exec-169869/.
[15] The average share answering "very" or "somewhat comfortable" to the question of how comfortable you feel about a company handling your personal data is 51% for Millennials, 44% for Generation X, 35% for Boomers, and 35% for Silent Generation. Matthew Quint and David Rogers (2015) "What Is the Future of Data Sharing?" *Columbia Business School*, https://www8.gsb.columbia.edu/globalbrands/sites/globalbrands/files/images/The_Future_of_Data_Sharing_Columbia-Aimia_October_2015.pdf, ("Quint and Rogers (2015)"), p. 15.
[16] Global Data and Marketing Alliance (2022), p. 7.
[17] Alessandro Acquisti, Laura Brandimarte, and George Loewenstein (2015) "Privacy and human behavior in the age of information," *Science*, 347(6221):509-514, https://www.science.org/doi/10.1126/science.aaa1465, ("Acquisti et al. (2015)"), p. 511.
[18] Jeffrey Prince and Scott Wallsten (2020) "How Much is Privacy Worth Around the World and Across Platforms?" *The 48th Research Conference on Communication, Information and Internet Policy*, TPRC48, http://dx.doi.org/10.2139/ssrn.3528386, p. 5. *See,* similarly, Scott J. Savage and Donald M. Waldman (2013) "The Value of Online Privacy," *University of Colorado at Boulder Department of Economics*, http://dx.doi.org/10.2139/ssrn.2341311, p. 1.
[19] Global Data and Marketing Alliance (2022), p. 18.

transparency regarding the collection and use of personal data has declined from 84% to 67%, and the importance of understandable, easy-to-read terms and conditions has decreased from 84% to 66%.[20] Furthermore, the percent of people who were comfortable with businesses sharing personal information with other organizations for personalized services and products has increased from 30% in 2018 to 44%.[21]

18. Users' willingness to share data can also be driven by their inclination for enhancing the public good.[22] For instance, my coauthors and I analyzed 22 billion records regarding individual user-level location data from smartphone apps in 20 U.S. cities in the year 2020.[23] We found that, after the onset of the COVID-19 pandemic, users less frequently opted out of location sharing on their mobile devices.[24] We further found that this effect was heterogeneous; for instance, the effect varied by differing political views, gender, socioeconomic status, and race.[25] Similarly, an online survey of 2,038 respondents in the U.S. found that 58% of consumers agreed that sharing personal data helps organizations meet the needs of a diverse society and that agreement varied notably by age and gender.[26]

19. User perspectives on privacy can also change with greater experience in a given app or environment. For instance, one survey found that "experience using mobile applications did moderate the effect of individual preferences and contextual factors on privacy judgments" and "changed the equation respondents used to assess whether data collection and use scenarios met their privacy expectations."[27] Moreover, personal data change over time, with old data sometimes becoming stale.[28] This is another reason why users' valuation of data privacy may vary in value over time depending on the context.

20. Privacy-related perceptions also vary by personalities of users. Pentina et al. (2016) find that "certain personality traits, namely extraversion and agreeableness, increase user perceptions of benefits obtained

[20] Global Data and Marketing Alliance (2022), pp. 4-5, 19.
[21] Global Data and Marketing Alliance (2022), p. 5.
[22] Anindya Ghose, Beibei Li, Meghanath Macha, Chenshuo Sun, and Natasha Zhang Foutz (2022) "Trading Privacy for Public Good: How Did America React During COVID-19?" *NYU Stern School of Business*, http://dx.doi.org/10.2139/ssrn.3624069, ("Ghose et al. (2022)").
[23] Ghose et al. (2022), p. 1.
[24] Ghose et al. (2022), p. 1.
[25] Ghose et al. (2022), p. 4.
[26] Global Data and Marketing Alliance (2022), p. 27.
[27] Kirsten Martin and Katie Shilton (2016) "Why Experience Matters to Privacy: How Context Based Experience Moderates Consumer Privacy Expectations for Mobile Applications," *Journal of the Association for Information Science and Technology*, 67(8):1871-1882, https://doi.org/10.1002/asi.23500, p. 1871.
[28] For example, according to the American Community Survey, approximately 13% of Americans moved between 2017 and 2018 (the most recent year for which data are available). Riordan Frost (2020) "Are Americans Stuck in Place? Declining Residential Mobility in the US," *Joint Center for Housing Studies of Harvard University*, https://www.jchs.harvard.edu/sites/default/files/harvard_jchs_are_americans_stuck_in_place_frost_2020.pdf.

from adoption and use of [mobile apps that require access to private personal information] irrespective of the cultural or national environments."[29]

21. In short, as a report from the Organization for Economic Co-Operation and Development put it, "people tend to differ with respect to their individual valuation of personal data … and their individual valuation of privacy … [E]mpirical studies point out that both the *valuation of privacy* and the *valuation of personal data* are extremely sensitive to contextual effects," and "cannot be measured with an absolute certainty and precision."[30]

B. The "privacy paradox" makes it very difficult to accurately gauge users' willingness to share personal data

22. A digital platform's ability to develop a privacy policy and features to satisfy heterogeneous user tastes is further limited by the fact that it is often very difficult to determine users' true preferences for privacy.[31] Policies and features should reflect what a platform's users want, and even with a well-designed survey or other data, what users say they want (stated preferences) is often at odds with what their behavior reveals (revealed preferences). This is reflected in the fact that actual user choices are often inconsistent with what users say in surveys about the importance of privacy, a phenomenon recognized in the literature as the "privacy paradox."[32] As one review of the literature explained, "when it comes to social media use … even individuals who express concerns [about privacy] behave quite carelessly, engaging in uncensored or inappropriate self-disclosure, making a great deal of their digital footprint public, and allowing a wide range of external apps to access their data."[33] As I wrote about this privacy

[29] Iryna Pentina, Lixuan Zhang, Hatem Bata, and Ying Chen (2016) "Exploring privacy paradox in information-sensitive mobile app adoption: A cross-cultural comparison," *Computers in Human Behavior*, 65:409-419, https://doi.org/10.1016/j.chb.2016.09.005, p. 417.
[30] OECD (2013) "Exploring the Economics of Personal Data: A Survey of Methodologies for Measuring Monetary Value," *OECD Digital Economy Papers*, 220, https://doi.org/10.1787/20716826, pp. 5, 30, emphasis in original.
[31] Note that a majority of U.S. adults who read privacy policies say they typically understand them. Roughly two-thirds of adults who read privacy policies say they typically understand a great deal (13%) or some (55%) of the policies that they read. Pew Research (2019) "4. Americans' attitudes and experiences with privacy policies and laws," *Pew Research Center*, https://www.pewresearch.org/internet/2019/11/15/americans-attitudes-and-experiences-with-privacy-policies-and-laws/.
[32] Acquisti et al. (2015) states that "doubts about the power of attitudinal scales to predict actual privacy behavior arose early in the literature. This discrepancy between attitudes and behaviors has become known as the 'privacy paradox.'" Acquisti et al. (2015), p. 510. Other authors explain, "[t]his research explores what we call the 'privacy paradox' or the relationship between individuals' intentions to disclose personal information and their actual personal information disclosure behaviors." Patricia A. Norberg, Daniel R. Horne, and David A. Horne (2007) "The Privacy Paradox: Personal Information Disclosure Intentions versus Behaviors," *Journal of Consumer Affairs*, 41(1):100-126, https://doi.org/10.1111/j.1745-6606.2006.00070.x, p. 100.
[33] Tomas Chamorro-Premuzic and Nathalie Nahai (2017) "Why We're So Hypocritical About Online Privacy," *Harvard Business Review*, https://hbr.org/2017/05/why-were-so-hypocritical-about-online-privacy.

paradox in 2017, "[p]eople are full of contradictions" when it comes to data privacy and appear to "care a lot about data privacy," but nevertheless are willing to share data in order to engage meaningfully with social media.[34]

23. Given the apparent willingness of users to share their data to enhance the user experience, any attempt to ask users to take effort or experience a reduced user experience to achieve greater privacy may actually have little impact if users forego the effort.[35] Gerber et al. (2018) states that "survey results show that the privacy of their personal data is an important issue for online users worldwide, [but] most users rarely make an effort to protect this data actively and often even give it away voluntarily."[36] In part, the privacy paradox results from the fact that, in the abstract, users often claim to care substantially about privacy, but when faced with real-world decision-making that requires balancing privacy concerns with value generated by online activity, the calculus often favors the latter.[37]

24. Gerber et al. (2018) describe this concept as the privacy calculus: "if the anticipated benefits of data sharing exceed the costs, a user is expected to willingly give his/her data away."[38] In addition: "The benefits someone can gain through data disclosure represent important predictors for a user's behavioral intention as well as willingness to disclose data, either in a general way ('perceived benefit/value', 'perceived usefulness') or rather concrete ('liked targeted ads')."[39]

[34] Anindya Ghose (2017) "When push comes to shove, how quickly will you give up your data for convenience?" *Quartz*, https://qz.com/973578/data-privacy-doesnt-seem-to-be-a-concern-for-mobile-users-willing-to-swap-it-for-convenience/.
[35] "[W]henever privacy requires additional effort or comes at the cost of a less smooth user experience, participants are quick to abandon technology that would offer them greater protection. This suggests that privacy policy and regulation has to be careful about regulations that inadvertently lead consumers to be faced with additional effort or a less smooth experience in order to make a privacy-protective choice." Susan Athey, Christian Catalini, and Catherine Tucker (2017) "The Digital Privacy Paradox: Small Money, Small Costs, Small Talk," *National Bureau of Economic Research Working Paper*, 23488, p. 18.
[36] Nina Gerber, Paul Gerber, and Melanie Volkamer (2018) "Explaining the privacy paradox: A systematic review of literature investigating privacy attitude and behavior," *Computers & Security*, 77:226-261, https://doi.org/10.1016/j.cose.2018.04.002, ("Gerber et al. (2018)"), p. 226.
[37] "Privacy calculus theory postulates that individuals perform a calculus between the *expected loss of privacy* and the *potential gain of disclosure*. Their final behaviour is determined by the outcome of the privacy trade-off … In social interactions rewards are mostly intangible and thus difficult to observe. As a result the disclosing behaviour of users often seems unreasonable and inconsistent with their privacy concerns." Spyros Kokolakis (2017) "Privacy attitudes and privacy behavior: A review of current research on the privacy paradox phenomenon," *Computers & Security*, 64:122-134, https://doi.org/10.1016/j.cose.2015.07.002, p. 128.
[38] Gerber et al. (2018), p. 229.
[39] Gerber et al. (2018), p. 245.

25. Surveys of privacy opinions can also depend significantly on subtleties of wording and framing, making it difficult to elicit with precision how users really feel.[40] One also needs to keep in mind whether a survey is properly designed, for example, whether the sample is representative of the target population and sufficient in size, whether a control group is included if a causal proposition is tested, whether questions are clear and unbiased, and other aspects of survey design.[41] For example, in a survey on privacy, whether respondents are presented with tradeoffs is typically an important aspect of design. Other researchers conclude that preferences for privacy are simply not stable or well-defined, and therefore "attempts to pinpoint exact valuations that people assign to privacy may be misguided, as suggested by research calling into question the stability, and hence, validity, of privacy estimates."[42] For example, "[t]hough consumers express strong privacy concerns in surveys, […] only 0.23% of American ad impressions arise from users who opted out of online behavioral advertising."[43] In any case, as I put it in my book, "there is a disconnect between our understanding of what it means to be privacy-conscious in the mobile economy and the actions we are taking in the real world."[44] Further, as I have stated before, there is ample heterogeneity in the extent of this disconnect between actions and claims among users based on demographic attributes like age such that Millennials and users in the Gen Y and Gen Z categories may behave differently than Baby Boomers and users in the Gen X category.[45]

26. Another approach commonly applied in the privacy literature is to analyze whether users of a product were adequately informed by examining whether they change their behavior after purportedly undisclosed information is revealed. For instance, in one study, the authors examined whether Equifax customers behaved differently once they became aware of the data breach. As the researchers found, they did not:

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[40] Idris Adjerid, Alessandro Acquisti, Laura Brandimarte, and George Loewenstein (2013) "Sleights of Privacy: Framing, Disclosures, and the Limits of Transparency," *Proceedings of the Ninth Symposium on usable privacy and security*, SOUPS '13(9):1-11, https://doi.org/10.1145/2501604.2501613, pp. 1-11. Another paper explains, "Individuals assigned markedly different values to the privacy of their data depending on (1) whether they were asked to consider how much money they would accept to disclose otherwise privacy information or how much they would pay to protect otherwise public information and (2) the order in which they considered different offers for their data … The results highlight the sensitivity of privacy valuations to contextual, nonnormative factors." Alessandro Acquisti, Leslie K. John, and George Loewenstein (2013) "What Is Privacy Worth?" *Journal of Legal Studies*, 42(2):249-274, https://doi.org/10.1086/671754, p. 249.

[41] For a general discussion on survey design, see Shari Seidman Diamond (2011) "Reference Guide on Survey Research," in *Reference Manual on Scientific Evidence, Third Edition, Federal Judicial Center*, pp. 359-423.

[42] Acquisti et al. (2015), p. 510.

[43] Garrett A. Johnson, Scott K. Shriver, and Shaoyin Du (2020) "Consumer Privacy Choice in Online Advertising: Who Opts Out and at What Cost to Industry?" *Marketing Science*, 39(1):33-51, https://pubsonline.informs.org/doi/abs/10.1287/mksc.2019.1198, p. 33.

[44] Anindya Ghose (2017), "Tap: Unlocking the Mobile Economy," *MIT Press*, ("Ghose (2017)"), p. 39.

[45] Wharton (2017) "Embracing Contradiction: Your Customers Aren't Always Who They Say They Are," https://executiveeducation.wharton.upenn.edu/thought-leadership/wharton-at-work/2017/03/embracing-contradiction/.

"Although many participants were aware of and concerned about the Equifax breach, few knew whether they were affected, and even fewer took protective measures after the breach."[46] In other words, even after consumers learn that their data had been stolen (not just shared with another app), they very rarely did anything to limit the risk they faced. Other published studies have also used a similar methodology to analyze the adequacy of disclosure. One particular study of this nature, which evaluated user responses to news about the Cambridge Analytica incident, found that "[c]ontrary to many opinions reported in the news, the respondents in our sample did not delete their accounts, frantically change their privacy settings, or even express that much concern."[47]

27. Additional research has shown that users are more willing to trade-off their privacy, including location data, for improved service quality or scope, consistent with the privacy calculus theory, when they perceive benefits from sharing private information:

a. Lee et al. (2013): "both expected benefit and expected risk significantly influenced users' intention to share."[48]

b. Keith et al. (2013): "increase in perceived privacy risk from a new mobile app decreases an individual's intent to disclose information through the app significantly, while perceived benefits increase this intention." Moreover, "[p]erceived benefits and risks are [an] efficient way of predicting the actual privacy settings decided upon."[49]

c. Koohikamali et al. (2015): "if there is a perceived benefit for sharing location on LB-SNAs [location based social networking algorithms] people will have a more positive attitude about location disclosure." Specifically, "[t]he idea that there is a societal gain for the use of the

[46] Yixin Zou, Abraham H. Mhaidli, Austin McCall, and Florian Schaub (2018) "I've Got Nothing to Lose": Consumers' Risk Perceptions and Protective Actions after the Equifax Data Breach," *Fourteenth Symposium on Usable Privacy and Security, USENIX*, 197-216, https://www.usenix.org/system/files/conference/soups2018/soups2018-zou.pdf.
[47] Joanne Hinds, Emma J. Williams, and Adam N. Joinson (2020) "'It wouldn't Happen to Me': Privacy Concerns and Perspectives Following the Cambridge Analytica Scandal," *International Journal of Human-Computer Studies*, 143:1-14, https://doi.org/10.1016/j.ijhcs.2020.102498, p. 1.
[48] Haein Lee, Hyejin Park, and Jinwoo Kim (2013) "Why do people share their context information on Social Network Services? A qualitative study and an experimental study on users' behavior of balancing perceived benefit and risk," *International Journal of Human-Computer Studies*, 71(9):862-877, https://doi.org/10.1016/j.ijhcs.2013.01.005, p. 871.
[49] Mark J. Keith, Samuel C. Thompson, Joanne Hale, Paul Benjamin Lowry, and Chapman Greer (2013) "Information disclosure on mobile devices: Re-examining privacy calculus with actual user behavior," *International Journal of Human-Computer Studies*, 71(12):1163-1173, https://doi.org/10.1016/j.ijhcs.2013.08.016, p. 1170.

tool can have an impact on attitudes. People, generally, will look to benefit society if it is easy."[50]

C. User benefits from location-based services

28. Consumers derive benefits from various location-based services ("LBS"), including through the use of location-based services apps.[51] LBS apps rely on a user device's location to provide app services and relevant information to the user based in part on their location. As I discuss below, the benefits provided from these apps include (among many others): real-time navigation between home and work (e.g., Google Maps),[52] the location of the nearest restaurant (e.g., Google Search or Maps), real-time weather in the user's location, the ability to hail ride sharing services, and finding nearby attractions for touristic purposes.

29. Location-based services apps are used by most consumers. A Pew Research Center survey conducted in 2015 reports that 90% of U.S. consumers have used their smartphones to get directions, recommendations, or other information related to their location.[53] Another 2013 survey found that 74% of 2,252 U.S. adult smartphone users use directions or other information based on their location.[54] And a 2018 survey found that 54% of 20,409 online U.S. respondents used their phone to use online maps or navigation services in the last four weeks of 2018.[55] A survey conducted in European and South and North American countries (including U.S.) found similar results, i.e., that "more than one in ten mobile users always allow mobile location tracking, a further almost eight in ten sometimes allow such tracking,

[50] Mehrdad Koohikamali, Natalie Gerhart, and Mohammadreza Mousavizadeh (2015) "Location disclosure on LB-SNAs: The role of incentives on sharing behavior," *Decision Support Systems*, 71:78-87, https://doi.org/10.1016/j.dss.2015.01.008, pp. 80, 83.
[51] Rick Shah (2020) "How a Location-based app will help users? benefits of having a location-based app," https://www.linkedin.com/pulse/how-location-based-app-help-users-benefits-having-rick-shah/.
[52] *See, e.g.*, Anindya Ghose, Hyeokkoo Eric Kwon, Dongwon Lee, Wonseok Oh (2019) "Seizing the Commuting Moment: Contextual Targeting Based on Mobile Transportation Apps," *Information Systems Research*, 30(1):154-174, https://doi.org/10.1287/isre.2018.0792, ("Ghose et al. (2019b)"), p. 156, Figure 1. *See also*, Ghose et al. (2019b), p. 157, Figure 2.
[53] Monica Anderson (2016) "More Americans using smartphones for getting directions, streaming TV," *Pew Research Center*, https://www.pewresearch.org/fact-tank/2016/01/29/us-smartphone-use/.
[54] Kathryn Zickuhr (2013) "Location-Based Services," *Pew Research Center*, https://www.pewresearch.org/internet/wp-content/uploads/sites/9/media/Files/Reports/2013/PIP_Location-based-services-2013.pdf.
[55] Statista (2018) "Share of Americans who used their cell phone for online map or navigation services in the last four weeks in 2018, by age," https://www.statista.com/statistics/231615/people-who-use-their-cell-phone-for-maps-gps-navigation-usa/.

while less than one in ten never allow it."[56] Below I discuss examples of different location-based services apps and how these have benefited users.

30. Navigation apps such as Google Maps and Apple Maps utilize a user's location to provide the user with real-time navigation capability, including driving, public transit or walking directions from the user's current location to their destination, and estimates of traffic based on crowdsourced location sensor data.[57] In 2021, Google Maps and another Google app, Waze, were the top two navigational apps, with 25,463,180 and 13,421,072 downloads in the U.S. respectively.[58] A study by Factual found that "[n]avigation sites and apps like Waze," topped the list of the types of apps that respondents are most comfortable sharing data with.[59] Similarly, the 451 Alliance study finds that 58% of respondents are willing to opt-in to turn on their location services to get directions.[60] Additionally, Brynjolfsson et al. (2019) ran experiments on a representative sample of the U.S. internet population, where respondents were asked to consider giving up access to, e.g., digital maps, for an entire year. The median estimate to give up access to digital maps for a year was $3,648 in 2017.[61]

31. Another use of location-based services apps is in local search. Apps such as Google Search, Google Maps, and Yelp assist users in locating nearby restaurants and businesses or searching for other things nearby by utilizing the user's location data. One of the main consumer benefits of location assisted search apps is the significant reduction in search costs associated with locating local points of interest. Other apps that allow users to search for information nearby include GasBuddy, which shows gas prices at

[56] Anabel Gutierrez, Simon O'Leary, Nripendra P. Rana, Yogesh K. Dwivedi, and Tatiana Calle (2019) "Using privacy calculus theory to explore entrepreneurial directions in mobile location-based advertising: Identifying intrusiveness as the critical risk factor," *Computers in Human Behavior*, 95:295-306, https://doi.org/10.1016/j.chb.2018.09.015, p. 300.
[57] Beth Brindle (2021) "How Does Google Maps Predict Traffic?" https://electronics.howstuffworks.com/how-does-google-maps-predict-traffic htm; As I note in Ghose et al. (2019b), "iPhone users can instantly start the navigation process of Google Maps and Apple Maps on their commuting routes right from the Home screen by using iPhone's 3D Touch technology." See Ghose et al. (2019b), p. 173, footnote 9.
[58] Statista (2021), "Leading mapping apps in the United States in 2021, by downloads," https://www.statista.com/statistics/865413/most-popular-us-mapping-apps-ranked-by-audience/.
[59] Factual (2019) "Consumers & Data Privacy Perceptions: Consumer Preferences & Behaviors on Data Sharing & Privacy," https://s3.amazonaws.com/factual-content/marketing/downloads/Factual-Consumers-Data-Privacy-Perceptions-Report.pdf, ("Factual (2019)"), p. 10.
[60] Michael Nocerino (2021) "Attitudes Toward Location-Based Services Vary by Age," https://blog.451alliance.com/attitudes-toward-location-based-services-vary-by-age/, ("Nocerino (2021)"), referencing 451 Alliance's Q1 2021 Survey.
[61] Erik Brynjolfsson, Avinash Collis, and Felix Eggers (2019) "Using massive online choice experiments to measure changes in well-being," *PNAS*, 116(15):7250–7255, https://doi.org/10.1073/pnas.1815663116, p. 7251–7252.

stations near the users,[62] and Airbnb, which offers experiences tailored to a user's location.[63] A 2016 study by Google found that 76% of people who search on their smartphones for something nearby visited the business within a day,[64] indicating that the ability of searching for businesses nearby is important and beneficial to users.

32. Consumers also value and use location-based services to get timely and "relevant content based on location," e.g., weather and news.[65] For example, Google News can be set up to deliver local news to users, either based on their location or based on their home and work addresses.[66] Additionally, the app Dark Sky provides weather information specific to the user's "exact location."[67] In an analysis by George and Hogendorn (2019), they found that the addition of geo-targeted links to the Google News site increased "the share of local content in household news consumption," which indicates the value that localized information has to users.[68]

33. Similarly, ride-sharing apps like Uber and Lyft also rely on location data to match riders with nearby drivers in order to get users to their destination. Hwang et al. (2020) estimated that "[c]onsumers gain roughly $1 billion annually from Uber's non-fare attributes, which they value but taxis have not provided."[69] Another study by Cohen et al. (2016) found that "in 2015 the UberX service generated about $2.9 billion in consumer surplus in the four U.S. cities included in [the] analysis. For each dollar spent by consumers, about $1.60 of consumer surplus is generated."[70]

[62] Andrew Kunesh (2022) "How to use GasBuddy to get ahead of summer's fuel price surge," https://thepointsguy.com/guide/gasbuddy-guide/.
[63] Airbnb (2022) "An introduction to Airbnb Experiences," https://www.airbnb.com/help/article/1581/an-introduction-to-airbnb-experiences.
[64] Think with Google (2016) "How Mobile Search Connects Consumers to Stores," *Think With Google,* https://www.thinkwithgoogle.com/marketing-strategies/app-and-mobile/mobile-search-trends-consumers-to-stores/.
[65] Nocerino (2021).
[66] Google News Help (2022) "Get local news for cities you're interested in," https://support.google.com/googlenews/answer/9256668?hl=en&co=GENIE. Platform%3DAndroid&oco=0.
[67] Jason Cipriani (2014) "Dark Sky review: Dark Sky is a weather app you won't mind paying for," https://www.cnet.com/reviews/dark-sky-review/.
[68] Lisa M. George and Christiaan Hogendorn (2019) "Local News Online: Aggregators, Geo-Targeting and the Market for Local News," http://dx.doi.org/10.2139/ssrn.2357586, p. 24.
[69] Hyeonjun Hwang, Clifford Winston, and Jia Yan (2020) "Measuring the Benefits of Ridesharing Services to Urban Travelers: The Case of The San Francisco Bay Area," *Hutchins Center Working Paper*, 70, https://www.brookings.edu/research/measuring-the-benefits-of-ridesharing-services-to-urban-travelers/, p. 1.
[70] Peter Cohen, Robert Hahn, Jonathan Hall, Steven Levitt, and Robert Metcalfe (2016) "Using Big Data to Estimate Consumer Surplus: The Case of Uber," *NBER Working Paper*, 22627, https://www.nber.org/papers/w22627, p. 1.

D. User benefits from targeted advertisements and personalization

34. Consumers also derive benefits from targeted advertising, including location-based targeting, which is one of several targeting criteria used in advertising.[71] Location data can also be used in combination with other data such as search queries, consumer demographics, browsing and purchase history, temporal data, or behavioral data, amongst other things, to personalize advertisements.[72] For instance, in my book, I demonstrate that location is one of nine forces that can be used by firms to drive consumers' purchase decisions using data from smartphones.[73] Location-based advertising uses location information to target consumers based on either their historical location data or their real-time location data or both.[74] Specifically, location-based mobile advertising, a specific form of targeted advertising, enables businesses to deliver "to mobile users in real time, information on offers available in close proximity to them."[75] While location-based marketing is not new (e.g., consumers have received targeted radio or television advertisements for decades, not to mention billboards placed along certain location-targeted roadways), it previously only enabled businesses to target consumers at a more aggregate, for example, the zip-code level and was not able to target consumers using more precise location.[76] Currently, with the advent of smartphones, advertisers can target a variety of locations, including a radius around a location or even more granular location coordinates.

[71] For example, "[s]ay your favorite brand has a mobile app. If you're a smartphone user with the said app, then your location settings must be enabled so you as the customer can receive push notifications about local promotions and events. Businesses use to cater to your needs with their brand wherever you are. It's that simple." Aileen Padua (2020) "Location Based Marketing – The Ultimate Guide," https://www.techfunnel.com/martech/location-based-marketing/.

[72] Mark Altaweel (2020) "Geotargeting by Advertisers and Government Agencies," *GIS Industry*, https://www.gislounge.com/geotargeting-by-advertisers-and-government-agencies/; Startup Info (2022) "Customize Content Based on Your Customers' Location With API," https://startup.info/customize-content-based-on-your-customers-location/; Other authors explain, "[w]hen [firms] know where customers are and how they behave, [they] can not only customize offers, [they] can also offer rewards and a personalized experience." Annaysa Salvador Muniz Kamiya and Diana Sinclair Pereira Branisso (2021) "In the right place at the right time: a review of mobile location-based marketing and a research agenda," *Brazilian Journal of Marketing*, 20(2):199-225, https://doi.org/10.5585/remark.v20i2.18713, p. 214; *See also*, Xueming Luo, Michelle Andrews, Zheng Fang, and Chee Wei Phang (2014) "Mobile Targeting," *Management Science*, 60(7):1738-1756, http://dx.doi.org/10.1287/mnsc.2013.1836; Dominik Molitor, Peter Pal Zubcsek, Martin Spann, and Philipp Reichhart (2022) "Repeated Exposures to Mobile Advertising: The Role of Location Revisits," http://dx.doi.org/10.2139/ssrn.4071412, ("Molitor et al. (2022)").

[73] "[C]ontext, location, time, saliency, crowdedness, weather, trajectory, social dynamics, and technology mix." Ghose (2017), p. 41.

[74] Molitor et al. (2022).

[75] Ghose et al. (2019a), p. 5027.

[76] Ghose (2017), pp. 60-61.

1. User awareness of and attitudes towards the use of (location) data in targeted advertisements

35. The majority of consumers are aware of the use of location data in targeted advertisements. According to a survey by Factual, 59% of respondents (1,002 smartphone users in the U.S., aged 18-65) believed that location data are used to "provide targeted or tailored advertising and offers,"[77] and the majority of respondents are comfortable or indifferent to sharing their location data for marketing purposes.[78] Similarly, Merkle, in its 2021 Consumer Experience Sentiment Report, found that "consumers are becoming more willing to give their [location] information in order to receive more personalized experiences."[79] In its Q1 2022 Customer Engagement Report, Merkle stated that consumers have a "sophisticated understanding of data privacy and collection" and are "open to establishing value exchanges that grant brands access to the data necessary to deliver the tailored customer experiences expected today."[80] Similar findings have been found in studies focusing on location-based coupons. A survey conducted in 2015 comprising 8,000 consumers in five countries, including the U.S., found that 69% of respondents were willing to share personal data in exchange for location-based discounts.[81]

36. Some consumers see the value from targeting and personalization based on location, contextual information, and/or other factors: a 2014 Google/Ipsos study found that "four in five consumers want search ads to be customized to their city, zip code or immediate surroundings."[82] Personalization in search ads also provides a lift in conversions.[83] This is consistent with a 2015 survey that found that nearly 50% of mobile consumers wanted sellers to send location-based coupons to them when they are near a store.[84] Other Google and Ipsos studies have found that users "expect brands to gather enough contextual

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[77] Factual (2019), pp. 3, 7.
[78] Factual (2019), p. 7.
[79] Merkle (2021) "2021 Consumer Experience Sentiment Report," https://www merkleinc.com/thought-leadership/white-papers/2021-consumer-experience-sentiment-report?utm_source=PressRelease&utm_medium=pr&utm_campaign=2021_Merkle_AMER_2021_DX_Experience_Sentiment_Survey, ("Merkle (2021)"), p. 6; Merkle (2021) "Merkle's Annual Consumer Experience Sentiment Report Explores Consumer Privacy Preferences and Brand Loyalty," https://www.merkleinc.com/news-and-events/press-releases/2021/merkles-annual-consumer-experience-sentiment-report-explores.
[80] Merkle (2022), "Consumer Sentiment Around Online Privacy and Data Collection highlighted in Merkle's Q1 2022 Customer Engagement Report," https://www.merkleinc.com/news-and-events/press-releases/2022/consumer-sentiment-around-online-privacy-and-data-collection.
[81] Quint and Rogers (2015), pp. 5, 47.
[82] Think with Google (2014) "Infographic: Understanding Consumers' Local Search Behavior," *Think with Google*, https://www.thinkwithgoogle.com/marketing-strategies/search/how-advertisers-can-extend-their-relevance-with-search-infographic/.
[83] Marketing Charts (2016) "Half of Marketers Say Personalization Provides Major Uplift to Search Marketing Conversions," https://www marketingcharts.com/digital-71892.
[84] Ghose et al. (2019b), p. 155, referencing Michael-Jon Lazar (2015) "Easy Savings: 2015 Mobile Coupon Statistics," *ReadyCloud Suite*, https://www readycloud.com/info/one-click-savings-a-quick-look-at-2015-mobile-coupon-statistics.

information to deliver location-specific responses without someone having to search for anything more than just 'sushi.'"[85]

2. User surveys indicate that users recognize benefits from location-based advertising targeting and personalization

37. Results from consumer surveys also demonstrate that consumers are generally aware of the benefits that they can derive from personalization, including reduced search costs through product discovery, increased cost savings through price promotions as well as personalized offers. For example, a 2021 Consumer Experience Sentiment Report showed that the percentage of respondents who said that "personalization makes it easier to find products of interest" rose to 49% and 50% of respondents said that brands' use of their data helped them "discover more things that interest me."[86]

38. The Factual study referenced above also found that 53% of respondents agreed or somewhat agreed that "personalized content helps them find products/things they like," further supporting the notion that targeted advertising helps consumers reduce search costs and discover new products.[87] Similarly, an academic study found that location-based mobile promotions drives "contemporaneous sales" as it offers "utilities to consumers at the right time and right place," but also that these promotions "can boost product awareness for [] planned subsequent-days purchases,"[88] which suggests that location-based advertisements can have a positive effect on product discovery.

3. Other evidence demonstrates the value of location-based advertising targeting and personalization to users

39. Other evidence of the value that personalized and location-based advertisements have to consumers include studies that analyze the effectiveness of targeting on, for example, click-through rates for advertisements and coupon redemption. For example, my co-authors and I showed, among other things, that mobile coupons sorted by distance are more effective compared to randomly sorted coupons.[89]

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[85] Lisa Gevelber (2017) "Micro-Moments Now: 3 new consumer behaviors playing out in Google search data," *Think With Google*, https://www.thinkwithgoogle.com/consumer-insights/consumer-trends/micro-moments-consumer-behavior-expectations/, citing "Google Data, U.S., Jan. - June 2015 vs. Jan. - June 2017." *See also,* Lisa Gevelber (2017) "Micro-Moments Now: Why 'near me' intent is a 'near you' opportunity," *Think With Google,* https://www.thinkwithgoogle.com/marketing-strategies/app-and-mobile/local-search-mobile-search-micro-moments/.

[86] Merkle (2021), pp. 3, 6.

[87] Factual (2019), p. 9.

[88] Zheng Fang, Bin Gu, Xueming Luo, and Yunjie Xu (2015) "Contemporaneous and Delayed Sales Impact of Location-Based Mobile Promotions," *Information Systems Research,* 26(3):552–564, https://doi.org/10.1287/isre.2015.0586, p. 554.

[89] Dominik Molitor, Martin Spann, Anindya Ghose, and Philipp Reichhart (2020) "Effectiveness of Location-Based Advertising and the Impact of Interface Design," *Journal of Management Information Systems,* 37(2):431-456, https://doi.org/10.1080/07421222.2020.1759922, p. 26.

Additionally, as I also describe in my research, randomized field experiments have causally shown that advertisements based on both "location and time information can significantly increase consumers' likelihood of redeeming a geo-targeted mobile coupon."[90] Khajehzadeh et al. (2014) show that U.S. consumers find value in mobile coupons.[91]

40. In a recent paper, my co-authors and I found that while both mobile push (e.g., notifications are delivered when consumers are sufficiently close to a store) and mobile pull targeting (e.g., consumers actively search for offers mainly via a dedicated app) are viable targeting strategies in the context of location-based targeting, mobile push targeting is more effective.[92] In another randomized field experiment that my co-authors and I conducted, we found similar results, namely, that increasing the relevance of location-based advertisements by incorporating information on consumers' physical-movement trajectories can lead to higher redemption probability and faster redemption behavior.[93] We further found evidence of how trajectory-based mobile targeting makes customers' shopping experiences more efficient by reducing the amount of time consumers have to spend in the focal advertising store.[94] Similarly, a recent study by Molitor et al. (2022) found that ads received at a location that a consumer has previously visited (i.e., a "familiar location") had higher click odds than ads received at a new location.[95] A different experiment where consumers were told that an advertisement was personalized found that click rates increased by 11% and time spent viewing the product increased by 34%.[96] "Click-through rate" is a typically good measure of consumer engagement. That is, a consumer has a choice to click or not click on an ad, so if consumers choose to click on certain ads more than others, it indicates that consumers derived more value from those ads as compared to those that they do not engage with.

41. Consumers recognize the benefits of location-based advertising, coupons, and personalization. In a survey of 1,000 U.S. individuals by performance marketing agency Adlucent (2016), 71% responded that "they would prefer ads that are tailored to their personalized interests and shopping habits," the plurality

[90] Ghose et al. (2019a), p. 5027.
[91] Saman Khajehzadeh, Harmen Oppewal, and Dewi Tojib (2014) "Mobile coupons: what to offer, to whom, and where?" *European Journal of Marketing*, 49(5/6):851-873, https://doi.org/10.1108/EJM-04-2014-0252, pp. 856, 861, 866.
[92] Dominik Molitor, Martin Spann, Anindya Ghose, and Philipp Reichhart (2022) "Mobile Push versus Pull Targeting and Geo-Conquesting," https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4099626, p. 1.
[93] Ghose et al. (2019a), p. 5027. We also explain, "that location proximity alone is not sufficient for understanding and predicting consumers' physical behavior. Stronger predictors of individual future behavior are the fine-grained mobility traces, especially the semantic information (e.g., conditional and unconditional movement transition probabilities between stores) and temporal information." Ghose et al. (2019a).
[94] Ghose et al. (2019a), pp. 5027, 5036.
[95] Molitor et al. (2022).
[96] Leslie K. John, Tami Kim, and Kate Barasz (2018) "Ads that Don't Overstep," *Harvard Business Review*, https://hbr.org/2018/01/ads-that-dont-overstep.

of which feel this way because they will see more relevant advertising.[97] In an evaluation and comparison of attitudes towards location-based advertising, Kini and Suomi (2018) found that U.S. participants were more accepting of location-based advertising than European participants.[98] A survey of 228 consumers by Souiden et al. (2019) concluded that consumer attitudes towards location-based coupons are significantly determined by convenience and monetary and hedonic benefits.[99] Furthermore, a 2020 survey of 383 U.S. consumers showed the value of location-based advertisements and that the perceived benefit of opting-in to such advertising is enhanced when such ads are personalized and sent at the right time.[100]

42. The above findings suggest that many consumers are aware of the use of (location) data in targeted advertisements and personalized offers, and that they derive benefits from them.

4. A note on the balance between relevance and intrusiveness

43. A discussion of targeted and personalized advertisements would be incomplete without recognizing the fact that there is a fine balance between what feels relevant and what feels intrusive. For example, as I discussed in an interview in January 2017, "if consumers are willing to share more information about themselves, then brands will be able to use mobile as a concierge and as a butler."[101] In Google Search, for the ads at the top of search results, the user can click on three dots to see "About this ad" pop-up explaining what information was used to serve that ad to that user; the same pop-up includes an "Ad Settings" link that allows the user to change ad preferences.[102] I understand that the goal of these pop-ups is to increase transparency and to reduce the invasiveness of the ad. [103] The Google Ads personalization controls allow users to configure their preferences based on their interest in receiving targeted ads.[104] Additionally, as I've discussed in this section and in **Section II.A** above, users have divergent preferences with respect to how much they are willing to share, which necessarily implies that many users are

[97] Adlucent (2016) "71% of Consumers Prefer Personalized Ads," https://www.adlucent.com/resources/blog/71-of-consumers-prefer-personalized-ads/.
[98] Ranjan B. Kini and Reima Suomi (2018) "Changing Attitudes toward Location-Based Advertising in the USA and Finland," *Journal of Computer Information Systems*, 58(1):66-78, https://doi.org/10.1080/08874417.2016.1192519, pp. 71, 77.
[99] Nizar Souiden, Walid Chaouali, and Mona Baccouche (2019) "Consumers' attitude and adoption of location-based coupons: The case of the retail fast food sector," *Journal of Retailing and Consumer Services*, 47:116-132, https://e-tarjome.com/storage/panel/fileuploads/2019-06-17/1560743599_E11323-e-tarjome.pdf, pp. 122, 127.
[100] Jinhee Han, Mohammad Shahidul Kader, and Wi-Suk Kwon (2020) "Consumer's Mobile Location-Based Advertising Opt-In Intention," *International Textile and Apparel Association Annual Conference Proceedings*, 77(1), https://www.iastatedigitalpress.com/itaa/article/11756/galley/11169/view/, pp. 2-3.
[101] Knowledge at Wharton (2017) "The Right Way to Do Mobile Marketing," https://knowledge.wharton.upenn.edu/article/mobile-marketing/; *see also*, Ghose (2017), p. 38.
[102] Conversation with Karin Hennessy, Group Product Manager, Privacy and User Trust at Google, June 3, 2022.
[103] Conversation with Karin Hennessy, Group Product Manager, Privacy and User Trust at Google, June 3, 2022.
[104] Conversation with Karin Hennessy, Group Product Manager, Privacy and User Trust at Google, June 3, 2022.

comfortable with the use of location data to generate more relevant ads and recognize the benefits associated with targeted and personalized content.

44. Dr. Levy lists "harm to the public" as a factor relating to assessment of the "amount of penalties that should be imposed per violation" if civil penalties are applied.[105] Although Dr. Levy does not provide an economic or financial basis for this factor, any such analysis must include the consumer benefits of location-based services (LBS) and geotargeted advertising. Consumer benefits from geo-targeted advertising, LBS, and personalization are well-documented and pervasive across large segments of consumers and across time as I have discussed in this section. Google's location services and apps are frequently used by consumers. In order to generate a reliable assessment of the net effect to consumers, it is necessary to weigh the value of these benefits against any loss in value associated with the alleged conduct at issue in this case, which Dr. Levy fails to do.

III. DR. KING'S CONCLUSIONS REGARDING "HARMS FROM LOCATION DATA TRACKING" ARE UNSUPPORTED AND SOME OF THEM ARE NOT TIED TO ALLEGED CONDUCT AT ISSUE IN THIS CASE

45. Dr. King concludes in her report that "Google's systematic collection, storage, and processing of consumers' personal location harms consumers in ways that they cannot reasonably avoid."[106] Dr. King's conclusion is unsupported by the evidence she cites in her report. Drawing such a conclusion requires developing evidence that Google's alleged conduct at issue in this case caused the harm she alleges. Academic researchers typically employ scientific methods involving empirical analysis such as experiments, surveys, or statistical modeling to draw such causal conclusions. Such scientific methods allow researchers to rule out other, unrelated, or confounding factors that may have led to the alleged harm.

46. In fact, the academic literature on identifying and evaluating causal relationships has advanced in recent decades as researchers have developed a range of key steps and empirical methods to draw causal inference. Angrist (with co-author Alan Krueger) describes the key steps needed to identify a causal relationship, which starts with identifying actual and "counterfactual" states of the world.[107] In the current

[105] Levy Report, p. 54.
[106] King Report, p. 40.
[107] "The first step is to specify a causal question, which we think of as comparing actual and counterfactual states. The next step is to devise a strategy that can, in principle, answer the question. A critical issue in this context is how the causal effect of interest is identified by the statistical analysis. In particular, why does the explanatory variable of interest vary when other variables are held constant? Who is implicitly being compared to whom? Does the source of variation used to identify the key parameters provide plausible 'counterfactuals'? And can the identification strategy be tested in a situation in which the causal variable is not expected to have an effect? Finally, implementation of the empirical strategy requires appropriate data, and careful attention to the many measurement

context, that requires comparing outcomes with and without the alleged conduct at issue in this case. A critical issue in identifying causal relationships is that one of these states of the world is not typically observed and requires careful empirical analysis to evaluate. In order to overcome this limitation, a suite of empirical strategies have been developed in recent decades that make use of random or quasi-random variation, including field experiments, natural experiments, instrumental variable techniques, regression discontinuities, and difference-in-differences.[108] Choosing the right strategy from among this suite of techniques will often depend on the nature of the relationship being studied, the available data, and the potential confounding factors that need to be addressed to determine the causal effect. But in the absence of such techniques (or at least, some analysis of empirical data), identifying causal effects is not possible.

47. Here, Dr. King's conclusion that Google's alleged conduct at issue in this case caused harm to users in Arizona should have been supported by scientific methods in order to establish that harm has in fact occurred, to connect Google's alleged conduct at issue in this case as the cause of that harm, and to net out the supposed harm with the benefits consumers receive from the alleged conduct at issue in this case. But Dr. King has not used scientific methods of any kind and therefore has failed to support her conclusions in any reliable manner. In the absence of empirical evidence or other scientific methods, Dr. King's opinions rest on anecdotal evidence, her own subjective judgment and conjecture, and references to academic studies which do not support her conclusions.

A. Dr. King has acknowledged the importance of scientific methods in her own academic research

48. This lack of reliable methods in Dr. King's report is in contrast to her own academic research, in which Dr. King has used scientific methods. Dr. King noted in her report that her academic "research is grounded in both qualitative methods (such as interview studies) and quantitative methods (such as surveys, survey experiments, data analysis), as well as methods used by human-computer researchers and

problems that are likely to arise along the way." Joshua D. Angrist and Alan B. Krueger (1999) "Empirical Strategies in Labor Economics," Chapter 23 in *Handbook of Labor Economics*, 1278-1357, pp. 1354-1355. Professor Angrist (with co-author Jörn-Steffen Pischke) has published a well-known textbook on identifying causal relationships with empirical data. Joshua Angrist and Jörn-Steffen Pischke (2009) "Mostly Harmless Econometrics: An Empiricist's Companion," *Princeton University Press*. I have cited the classic book in at least two of my own academic publications. Panagiotis Adamopoulos, Vilma Todri, and Anindya Ghose (2020) "Demand Effects of the Internet-of-Things Sales Channel: Evidence from Automating the Purchase Process," *Information Systems Research*, 32(1):238-267, https://doi.org/10.1287/isre.2020.0962; Panagiotis Adamopoulos, Anindya Ghose, and Alexander Tuzhilin (2021) "Heterogeneous Demand Effects of Recommendation Strategies in a Mobile Application: Evidence from Econometric Models and Machine-Learning Instruments," *MIS Quarterly*, https://doi.org/10.48550/arXiv.2102.10468, ("Adamopoulos et al. (2021)").

[108] Joshua Angrist and Jörn-Steffen Pischke (2015) "Mastering 'Metrics: The Path from Cause to Effect," *Princeton University Press*, pp. xiii-xiv.

practitioners for the study of computer interfaces, such as heuristic analyses, and various forms of user interface testing."[109]

49. Dr. King's use of survey methods are reflected in eight published articles that she lists in her Exhibit A (Jennifer King, Ph.D. Resume, May 3, 2022). For example, in a prior survey research that she has published, she used random digit dialing to sample 991 California residents to evaluate their understanding of online privacy and their opinions of law enforcement's access to cell phone location information.[110] In this research she used Professor Alan Westin's segmentation methods, as I referenced in **Section II.A** above, to divide respondents into three groups based on their level of concern for privacy.[111] Of note, while she has used this type of segmentation in the past, and is therefore aware of it, she appears to assume throughout her report that everyone is a privacy fundamentalist, which is not supported by literature on the subject. She also used surveys and statistical hypothesis tests in other papers,[112] and in her dissertation.[113] Consistent with my discussion in **Section II.B**, Dr. King has recognized the existence of a "privacy paradox—the divergence between the generally high and consistent support for privacy found in both the opinion polling and survey modeling research and behavior" in her prior research.[114]

50. Unlike her academic research, Dr. King does not use quantitative or qualitative methods, surveys, or experiments in her expert report to support her conclusion that Google's alleged conduct at issue in this case supposedly causes consumer harm. As I discuss in detail below, Dr. King's conclusions about harms from Google's alleged conduct at issue in this case are only supported by anecdotal evidence at best, which does not constitute a reliable scientific method for drawing causal conclusions. Much of the anecdotal evidence that Dr. King cites would support alternative conclusions, including that users can

[109] King Report, p. 8.
[110] Jennifer King and Chris Jay Hoofnagle (2008) "A Supermajority of Californians Supports Limits on Law Enforcement Access to Cell Phone Location Information," http://dx.doi.org/10.2139/ssrn.1137988.
[111] I note that Dr. King used Alan Westin's three segments in a different study. Jennifer King (2014) "Taken Out of Context: An Empirical Analysis of Westin's Privacy Scale," https://cups.cs.cmu.edu/soups/2014/workshops/privacy/s1p1.pdf.
[112] Chris Jay Hoofnagle, Jennifer King, Su Li, and Joseph Turow (2010) "How Different are Young Adults From Older Adults When it Comes to Information Privacy Attitudes & Policies?" https://repository.upenn.edu/asc_papers/399/; Jennifer King, Airi Lampinen, and Alex Smolen (2011) "Privacy: Is There An App For That?" *Proceedings of the Seventh Symposium on Usable Privacy and Security*, SOUPS '11(12):1-20, http://dx.doi.org/10.1145/2078827.2078843; Christopher Thompson, Maritza Johnson, Serge Egelman, David Wagner, and Jennifer King (2013) "When it's better to ask forgiveness than get permission: attribution mechanisms for smartphone resources," *Proceedings of the Ninth Symposium on Usable Privacy and Security, Association for Computing Machinery*, SOUPS '13(1):1-14, http://dx.doi.org/10.1145/2501604.2501605.
[113] Jennifer King (2018) "Privacy, Disclosure, and Social Exchange Theory," https://escholarship.org/content/qt5hw5w5c1/qt5hw5w5c1_noSplash_90777658d72894758e2ffa5ed059a354.pdf, ("King Dissertation (2018)").
[114] King Dissertation (2018), p. 7.

benefit from location data. In addition, many of Dr. King's conclusions are not tied to the alleged conduct at issue in this case and therefore cannot be used to draw an inference that Google's alleged conduct at issue in this case supposedly caused harm. Finally, many of her opinions involve the words "can" and "could,"[115] which are at best hypotheses, not tested outcomes.

B. Dr. King's conclusions require use of scientific methods, but Dr. King has applied only anecdotal evidence, and therefore her conclusions are unreliable and unsupported

51. Each of Dr. King's conclusions in Section VI of her report on "Harms from location data tracking" are unsupported by reliable evidence. I describe her conclusions and her purported support below, and demonstrate that her support is either not tied to the claims in the matter and/or the information she cites does not support her conclusions.

1. Dr. King's conclusion that "Data Collection Implicates Privacy Concerns" is based on anecdotal evidence and is not tied to Google's alleged conduct at issue in this case

52. Dr. King concludes that "data collection implicates privacy concerns," and refers to concepts in privacy literature and anecdotal examples of situations she contends constitute privacy issues.[116] Among the concepts and examples she raises in this section, supposedly pertaining to the alleged harm, are (1) autonomy, (2) information asymmetry, (3) contextual integrity, and (4) contextual appropriateness.[117] I address Dr. King's discussion of each of these concepts.

a. Dr. King cites literature to define autonomy as "having control over the information others know about you … having the ultimate choice over what parts of your life you feel are fair and appropriate to share with companies for commercial decisions."[118] Dr. King then cites general claims from literature that while injuries from privacy harms are small, intangible, and difficult to track, they are experienced nonetheless.[119] However, she does not present any evidence that Google's alleged conduct at issue in this case removed user control of their information.[120] Similarly, she offers no evidence of any supposed harm–incremental or not–to users in Arizona.

[115] For example, Section VI.D of her report is titled "Location Data Collection **Can** Also Cause Financial Injuries to Consumers," emphasis added. *See also*, King Report, pp. 42, 44, 50, 52, 61, 68, 70.
[116] King Report, pp. 41-45.
[117] King Report, pp. 41-45.
[118] King Report, p. 41, emphasis removed.
[119] King Report, pp. 41-42.
[120] King Report, p. 41.

b. Dr. King claims that information asymmetry is relevant to determining potential harm.[121] However, Dr. King's only support for these claims is a reference to Target Corporation's use of customers' purchase history and other data to predict that certain customers are in the early stages of pregnancy.[122] This example is not tied to Google or Google's alleged conduct at issue in this case. Dr. King does not offer any reliable evidence in which Google's alleged conduct at issue in this case caused information asymmetry that led to harm for consumers in Arizona. Dr. King's discussion about information asymmetry also ignores consumer benefits associated with targeted advertisements partially based on location data (as discussed in **Sections II.C and II.D**, consumers benefit from apps that use location data and targeted advertising based in part on location data; research shows that some consumers are willing to share their location data). Additionally, Dr. King's discussion ignores the benefits that consumers derive from the "predictions" that companies make about them. For instance, the recommender systems literature shows that recommender systems and consumer feedback mechanisms reduce "consumer search costs," choice and information overload, as well as "uncertainty associated with the purchase of unfamiliar products."[123]

c. Dr. King claims that contextual integrity is relevant to determining potential privacy harms in this matter.[124] She provides one example in which the developer of a flashlight app was fined by the Federal Trade Commission for collecting user data and argues that the app's collection of data was not needed for the app's functionality. Again, this example is not tied to Google's alleged conduct at issue in this case. Dr. King does not specify how the alleged conduct at issue in this case supposedly violates "contextual integrity" and results in consumer harm, nor does she conduct any scientific analysis of such supposed effects.

d. Finally, Dr. King concludes that Google's use of WAA and other location data is not contextually appropriate, because "the consumer would not expect Google to collect location history through some other setting called 'Web & App Activity'" and that "if a user provides Google with their own location, that does not necessarily mean that the user has agreed to

[121] King Report, pp. 42-43.
[122] King Report, pp. 42-43.
[123] Bhavik Pathak, Robert Garfinkel, Ram D. Gopal, Rajkumar Venkatesan, and Fang Yin (2010) "Empirical Analysis of the Impact of Recommender Systems on Sales," *Journal of Management Information Systems*, 27(2):159-188, https://doi.org/10.2753/MIS0742-1222270205, pp. 160-161; Adamopoulos et al. (2021); and Anthony Jameson, Martijn C. Willemsen, Alexander Felfernig, Marco de Gemmis, Pasquale Lops, Giovanni Semeraro, and Li Chen (2015) "Human Decision Making and Recommender Systems," *Recommender Systems Handbook, Springer*, 611-648, https://doi.org/10.1007/978-1-4899-7637-6_18.
[124] King Report, p. 44.

allow Google to use that information for tracking others."[125] She does not support her statements about users' expectations with any scientific evidence. She did not interview a single consumer or conduct a survey (in Arizona or elsewhere) to establish to what degree, if any, consumers seek out location settings (WAA or others), what consumers' expectations are with respect to those settings, or to what extent those expectations or resulting behavior would be with different if the settings were different. She references the AP article, which itself does not provide evidence or data that could be used to support her conclusion. Her claims are thus based on anecdotal evidence at best. Her purported conclusion cannot be assumed to be true and can only be supported with empirical evidence of users' perceptions, which she did not provide.

2. Dr. King's conclusion that "The Paradigm Shift Towards Always-On Location Collection Implicates Privacy Concerns Specifically" is unsupported and not tied to Google's alleged conduct at issue in this case

53. In this section, Dr. King concludes that "Always-On Location Collection" on mobile devices raises privacy concerns.[126] To support this conclusion, she references the mapping of WiFi networks by Google Street View, Google's settlement with the FTC in a case of alleged sharing users' most frequent contacts, the use and collection of IP addresses, and the supposedly difficult means of opting out of location sharing.[127] She does not support any of her conclusions with actual empirical evidence. Furthermore, many of her conclusions are unrelated to Google's alleged conduct at issue in this case.

54. Among the points that Dr. King raises that are unrelated to the alleged conduct at issue in this case includes:

a. That "[s]martphones facilitated intimate surveillance by private actors,"[128] for which she provides no evidence that Google knew of or participated in user surveillance, how location data is stored within Google, who was provided access, or how that claim relates to the allegations in this matter. She also ignores the value added by location-based capabilities by smartphones at the time, which notified users when specific apps had access to a user's

[125] King Report, pp. 44-45. Dr. King states that contextual appropriateness means "that the request for location by the app is appropriate for the context in which you are providing it."
[126] King Report, pp. 45-49.
[127] King Report, pp. 45-49.
[128] King Report, p. 46.

location.[129] I have discussed other examples of value added by location-based apps in **Section II.C**.

b. That a 2011 discovery of "an unencrypted cache of location data stored on iPhones that revealed the geolocation information of hundreds of Wi-Fi hotspots and cell towers that the phones contacted during their use."[130] Apple's conduct in 2011 is unrelated to Google's alleged conduct at issue in this case. Dr. King's inferences about Google's collection and use of IP addresses by the IPGeo team to determine a user's location is entirely unsupported by this 2011 discovery pertaining to Apple's data collection practices.[131]

55. Finally, Dr. King's conclusion that Google does not provide users with methods to easily turn off location sharing is based on her "own experience" and an unreferenced internal Google document.[132] She does not provide any scientific evidence to demonstrate first that users in Arizona cannot easily turn off location sharing, and second, that Google's alleged conduct is this cause.

3. Dr. King's description of "How Google's Location Data Collection Harms Privacy" relies heavily on untested hypotheticals, anecdotes, and, in some cases, unsubstantiated assumptions and is unreliable

56. In this section, Dr. King concludes that Google's collection of location data harms privacy by (1) revealing sensitive locations and activity, (2) posing harm to vulnerable populations, and (3) being collected and used without transparency. I address each of Dr. King's claims.

57. First, Dr. King's claim that "Location Data Reveals Sensitive Locations and Activities" relies on hypothetical situations and a mischaracterization of how users set their home and work addresses.[133]

a. Dr. King states that location data "can cause concern if known to others or viewed out of context" and that it can "disclose sensitive personal activity about a person and their family," citing various examples of locations and activities that could be sensitive when recorded, such as medical or legal visits and political or religious gatherings.[134] However, Dr. King ignores situations where users would benefit from having a location history. Most importantly, the situations that Dr. King presents are only hypothetical, and she does not

[129] For example, a review of Google's first Android phone, the HTC Dream stated that, "Another nice feature of the Android Market is that each application has a list of warnings stating whether or not it'll have access to the Internet, the phone's GPS functionality, or your personal data." Bonnie Cha and Nicole Lee (2008) "Review: Google's HTC Dream phone − That's it?" *CNET*, http://www.cnn.com/2008/TECH/ptech/10/27/cnet.tmobile.g1/index html.
[130] King Report, p. 47.
[131] King Report, pp. 48-49.
[132] King Report, p. 49.
[133] King Report, p. 50.
[134] King Report, p. 50.

provide any empirical evidence or scientific data of her own to show or measure the extent to which, if any, users in Arizona were actually harmed because their location data collected by Google became "known to others or viewed out of context."

b. Additionally, Dr. King states that "the only way for Google ***not*** to infer a user's home and work is for the user to set 'home and work to arbitrary locations.'"[135] However, she ignores that users save their home and work addresses into Google Maps themselves, but they are not necessarily required to do so to use Google Maps or other Google services. [136]

58. Second, Dr. King's claim that "Location Data Poses Harm To Vulnerable Populations" is not tied to Google's collection and use of location data and is based on insufficient, hypothetical evidence.[137] Dr. King refers to "cases where the U.S. government and law enforcement agencies have purchased location data from commercial providers in order to track both individual and specific groups."[138] However, Dr. King does not tie these practices to Google's collection and use of location data in this matter, and the reference she cites has no mention of Google as a company that supposedly sold location data to the U.S. government or law enforcement agencies.

59. Third, Dr. King's claim that "Location Data is Collected and Used With a Lack of Transparency" ignores the reality of Google's location settings and relies on overly generalized claims.

a. Dr. King does not provide any evidence or scientific data of her own that would measure the extent, if any, that users in Arizona were systematically tracked without consent because they "wanted to obtain directions or look up the nearest grocery store."[139] Furthermore, Dr. King ignores the benefits of Google's collection of location data, which has allowed users to obtain directions or look up the nearest grocery store as quickly and efficiently as consumers would expect.

b. Dr. King adds that "smartphone app permissions as well as our phone's mobile operating system location settings can enable exactly that kind of [systematic] tracking even when we only intended for the use of our location for a specific context and for a specific moment in

[135] King Report, p. 51, emphasis in original.
[136] Specifically, Google explains to users how to initially set their home and work address, if they choose to do so, or delete their addresses. Google Maps Help (2022) "Set or change your home & work addresses," https://support.google.com/maps/answer/3093979?hl=en&co=GENIE.Platform%3DAndroid.
[137] King Report, p. 51.
[138] King Report, pp. 51-52.
[139] King Report, p. 52.

time."[140] Dr. King fails to tie this supposed practice to Google's alleged conduct at issue in this case and ignores that Android users are able to set the extent of individual apps' collection of user information to "always," "while using," or "never" before using the app and at any time afterwards.[141]

60. Fourth, Dr. King suggests that the "lack of transparency can be a source of anxiety."[142]

a. Dr. King offers no scientific evidence that the alleged conduct at issue in this case causes anxiety to users in Arizona, including with respect to Google supposedly "listening to them through their phones and secretly recording their conversations."[143] Further, the *Washington Post* article that Dr. King cites provides evidence in favor of Google's use of targeted advertising, which Dr. King ignores: "It helps businesses reach new audiences. It makes the ads you inevitably see better match your interests – spending money on new stuff is necessary sometimes. And it powers personalized experiences online. Thanks to data collection, TikTok learned to show me videos of [my favorite things] … There are plenty of brands that rely on targeted advertising and data collection for their revenue, including YouTube, Reddit and even The Washington Post."[144]

b. Dr. King quotes from an internal Google document titled "Location Platform in 2020," the following statement, "Google has a goal of gaining 'perfect' (i.e., complete) knowledge about its users."[145] However, the statement appears to be a "[v]ision."[146] And she ignores other goals of the Location Platform listed in the same document which include "to provide our users great value for their data and fully respect their privacy preferences" and "to infer the current and future state of users/world while consuming minimal data, resources and energy both on the server and client sides,"[147] which demonstrate Google's intent to provide a good user experience with their products while being minimally intrusive on user's devices.

[140] King Report, p. 52.
[141] Google Account Help (2022) "Choose which apps use your Android phone's location," https://support.google.com/accounts/answer/6179507?hl=en.
[142] King Report, p. 52.
[143] King Report, p. 53, referencing Coco Khan (2021) "Is my phone listening to me? We ask the expert," *The Guardian*, https://www.theguardian.com/lifeandstyle/2021/oct/29/is-my-phone-listening-to-me-we-ask-the-expert.
[144] Tatum Hunter (2021) "Ask Help Desk: No, your phone isn't listening to your conversations. Seriously," *The Washington Post*, https://www.washingtonpost.com/technology/2021/11/12/phone-audio-targeting-privacy/.
[145] King Report, pp. 54-55, referencing GOOG-GLAZ-00283334.
[146] GOOG-GLAZ-00283334 at 334.
[147] GOOG-GLAZ-00283334 at 334.

4. Dr. King's conclusion that "Location Data Collection Can Also Cause Financial Injuries to Consumers" relies on untested hypotheticals and is unreliable

61. Dr. King contends that the collection of location data causes financial harms to consumers including (1) the use of consumer's data resources, (2) ad and price discrimination, and (3) the inability to monetize their own data.

62. With respect to the first point, Dr. King only points to the existence, at least in the past, of limited data plans.[148] She does not offer any quantification of how the alleged conduct at issue in this case impacts, if at all, the data plan charges to consumers, and to what degree, if any, such charges relate to alleged misconceptions of users.

63. With respect to discrimination, Dr. King makes claims based on a study using Google's Ad Settings webpage to measure the impact of demographic settings on Google's ads.[149] Only location is at issue in this case, but the study does not use location as a dimension, as it uses controls "to prevent differences based on location [or] IP address" and primarily focuses on how gender settings affect ads or job listings received.[150] The authors acknowledge that they "cannot determine who caused these findings," which is not necessarily Google but could also be "advertisers, websites, and users."[151] Dr. King also ignores the fact that Google aims to provide a personalized experience[152] for users and that such personalized experiences have benefits for the user as I have discussed at length in **Section II.D**.

64. Finally, Dr. King claims that "Consumers Are Unable to Financially Benefit From the Use of Their Location Data" and that while there are some proposed ideas for user monetization of their data, large platforms like Google dominate the market, and consumers are unable to monetize their data at scale without government intervention.[153] Dr. King does not link this alleged harm to the alleged conduct at issue in this case. For example, she does not address or quantify the degree to which, if any, Google users

[148] King Report, p. 55.
[149] King Report, pp. 55-56, referencing Amit Datta, Michael Carl Tschantz, and Anupam Datta (2015) "Automated Experiments on Ad Privacy Settings: A Tale of Opacity, Choice, and Discrimination," *Privacy Enhancing Technologies Symposium, Proceedings on Privacy Enhancing Technologies*, 2015(1):92-112, https://doi.org/10.1515/popets-2015-0007, ("Datta et al. (2015)").
[150] Datta et al. (2015), p. 100.
[151] Datta et al. (2015), p. 92. Of note, the study defines "discrimination in the non-normative sense of the word" in that users received statistically different advertisements while using different settings, and that "people may disagree about whether we found discrimination in the normative sense." Datta et al. (2015), p. 94. The authors point out that "the discrimination might have resulted unintentionally from algorithms optimizing click-through rates or other metrics free of bigotry. Given the pervasive structural nature of gender discrimination in society at large, blaming one party may ignore context and correlations that make avoiding such discrimination difficult. More generally, we believe that no scientific study can demonstrate discrimination in the sense of *unjust discrimination* since science cannot demonstrate normative statements." Datta et al. (2015), p. 105, emphasis in original.
[152] *See, e.g.*, GOOG-GLAZ-00000054 at 055-056.
[153] King Report, pp. 56-57.

in Arizona would be able to monetize their location data if Google used a different UI or disclosures with respect to WAA and LH. She also fails to address or quantify the benefits users receive from Google's location-based services, many of which are free, (such as Google maps) as I have discussed at length in **Section II.C**.

5. Dr. King's conclusion that "Tracking Harms Are Not Reasonably Avoidable By Consumers" relies on untested hypotheticals and is unreliable

65. Dr. King contends that data collection is unavoidable to consumers because (1) smartphone APIs were designed to give user location information to developers, (2) Google's notice and consent practices are confusing to users, (3) Google's design does not match user's expectations for privacy, and (4) default settings are often not changed by users.

66. First, Dr. King contends that "All-or-Nothing [smartphone] API's Enabled Widespread Location Collection" because "originally," "any app could obtain some form of location data from an individual user without asking specific permission in real time" and thus "[f]rom the start, smartphones were designed to enable widespread data tracking."[154] This short section, consisting of only two paragraphs, seems to serve the sole purpose of setting up the narrative for the subsequent sections. Dr. King does not reference any sources in this section and does not link these claims to the alleged conduct at issue in this case. Dr. King does not specify the timing of when these events allegedly occurred or how they relate to LH or WAA or any of the alleged conduct at issue in this case. In fact, these claims are not even specific to Google but are about smartphones (including iPhones) in general. Dr. King also acknowledges that the goal of the APIs was "to create apps that were useful and personalizable for customers," and that the APIs were set up this way not only as an Android-specific practice, but also for iOS.[155]

67. Second, Dr. King then describes how "Mobile Permissions" evolved over time with a recurrent theme that the permissions were confusing to users[156] without offering reliable support (or any support for some of her statements).

a. Dr. King states that permissions presented to users at the time of app installation "used technical descriptions that non-technical people did not understand, making permissions lists

[154] King Report, pp. 59-60.
[155] King Report, pp. 59-60.
[156] King Report, pp. 60-62.

incomprehensible to the average consumer," which is supposedly demonstrated by two academic papers discussed below (one of which she co-authored).[157]

i. In King (2012), Dr. King performed qualitative interviews and exercises with 24 Apple iPhone and Google Android users to examine their privacy expectations with respect to applications accessing information through platform APIs. The qualitative interviews only included 13 Android users living in the San Francisco Bay Area, which she acknowledges is a "small sample size."[158] She also "caution[s] against extrapolating our findings to the broader population of smartphone users without further exploration and testing or concurring research."[159] Furthermore Dr. King acknowledges in her paper that "participants were far less concerned with sharing their location compared to other types of information available through the platforms' APIs."[160] Such research cannot be used for any reliable causal conclusions in this matter such as that specific permissions cause confusion or harm.

ii. The other paper Dr. King cites to support her statement about the "average consumer," Felt et al. (2012), describes an online survey of 308 Android users recruited through ads on their Android devices in the U.S. and Canada and a lab study of 25 Android users recruited on Craigslist in the San Francisco Bay Area.[161] The authors found that "17% of participants paid attention to permissions during installation [across the two studies], and only 3% of Internet survey respondents could correctly answer all three permission comprehension questions."[162] These findings suggest that, even if these studies are taken at face value, few Android users in the survey and the lab study paid attention to permissions, and it is this low interest, rather than the language describing the permissions themselves, that likely drives the supposedly low comprehension.

[157] King Report, p. 60, referencing in footnote 183, Jennifer King (2012) "How Come I'm Allowing Strangers To Go Through My Phone? Smartphones and Privacy Expectations," *Workshop on Usable Privacy and Security for Mobile Devices (U-PriSM) at SOUPS*, http://dx.doi.org/10.2139/ssrn.2493412, ("King (2012)"); Adrienne Porter Felt, Elizabeth Ha, Serge Egelman, Ariel Haney, Erika Chin, and David Wagner (2012) "Android permissions: user attention, comprehension, and behavior," *Proceedings of the Eighth Symposium on Usable Privacy and Security, Association for Computing Machinery*, SOUPS '12(3):1–14, https://doi.org/10.1145/2335356.2335360, ("Felt et al. (2012)").
[158] King (2012), p. 4.
[159] King (2012), p. 4.
[160] King (2012), p. 1.
[161] Felt et al. (2012), pp. 3-4.
[162] Felt et al. (2012), p. 1.

b. Dr. King explains that "[e]ven with the runtime permissions model, which presents real-time notifications and requests for location access [a practice started for Android in 2015], it is still difficult for users to understand how data is being collected in the aggregate."[163] She offers no support for whether and to what degree Android users in Arizona actually experience such a difficulty in understanding or are harmed by it or whether and to what degree their understanding or behavior would be different with a different set-up of the permissions.

c. Dr. King then attempts to link this supposed harm with the allegation that "[a]pps that are denied location run-time permissions are still able to obtain location data from the user from ***other*** apps that are granted permission."[164] However, she offers no evidence of whether and to what degree users in Arizona misunderstand location sharing across Google apps, are harmed by it, or whether and to what degree their understanding or behavior would be different with a different set-up of permissions.

d. Dr. King also attempts to link her arguments to other alleged conduct at issue in this case (e.g., being "unable to 'opt out' [or even know] of IPGeo and [redacted]," being difficult to "find[] the relevant settings that would stop location tracking" and that even after finding them the tracking would not stop, and difficulty in "[p]reventing Google from inferring a users' home or work location").[165] However, she does not offer any evidence of whether and to what degree users in Arizona indeed experience such difficulties or were harmed by them. For example, she does not test whether and to what degree users in Arizona sought to disable location, failed to do so, would be more successful with an alternative user interface, or would be less likely to use Google products and services with an alternative interface. Neither does Dr. King demonstrate that a single user who failed to disable location-related settings was actually harmed.

68. Third, Dr. King claims that "the design of these location features does not match what users expect or want" and that "Google knows users do not understand the settings […] the settings do not match their expectations."[166]

a. For the first part of this claim, Dr. King offers as evidence a variety of academic articles, none of which seem to be directly related to the alleged conduct at issue in this case. For example, Dr. King references a 2012 survey that suggests that a "large majority" (78%) of

[163] King Report, p. 61.
[164] King Report, pp. 61-62, emphasis in original.
[165] King Report, p. 62.
[166] King Report, pp. 63-64.

Americans "consider information on their mobile phones at least as private as that on their home computers," that a "plurality" (46%) believes that mobile location should not be stored and that 92% would "'definitely' or 'probably' not allow" "their cell providers to use their location data for targeted advertisements," and that location data should not be used for targeted advertising.[167] Even if taken at face value, these facts do not constitute reliable evidence. A belief that information on a phone is at least as private or more private than that on a home computer offers no information about the absolute valuation of privacy of information or data stored on a phone. Believing that location should not be stored does not necessarily mean that if it is stored, the consumers are harmed. And whether consumers would allow their *cell phone providers* to use their location data is irrelevant to the question of whether Arizona users are harmed by *Google's* alleged conduct at issue in this case. More importantly, such findings should not be taken at face value. As discussed in **Section II.B** above, there is ample evidence that privacy surveys are not representative of users' true behavior or attitudes towards privacy. Indeed, even in her own study discussed above (which Dr. King claims "support[s] these findings"[168]), "[t]he majority [of interviewees] reported clicking through or ignoring such [privacy] notices, while a few reported skimming them […] Only one participant reported the contents of a TOS or a privacy policy deterring him from installation of an application."[169] While Dr. King frames this behavior as "notice fatigue,"[170] these results suggest that most users do not have extensive privacy preferences in practice, even though they may claim that they have preferences when asked in an interview or survey. Further, as discussed in **Sections II.C** and **II.D** above, consumers derive value from location-based services and advertising which the study she relies on does not purport to measure. The same arguments apply to the multiple studies that she references to demonstrate the supposed "rich location privacy preferences."[171] Thus she offers no reliable support that "users' privacy wishes are not being met" as she claims.[172]

[167] King Report, p. 63, referencing in footnote 187, Jennifer M. Urban, Chris Jay Hoofnagle, and Su Li (2012) "Mobile Phones and Privacy," *BCLT Research Paper Series, UC Berkeley Public Law Research Paper*, 2103405, http://dx.doi.org/10.2139/ssrn.2103405, pp. 9, 19, 20.
[168] King Report, p. 63, referencing King (2012).
[169] King (2012), p. 8.
[170] King (2012), p. 8.
[171] King Report, p. 64.
[172] King Report, p. 64.

b. As for the argument that "Google knows users do not understand the settings […] the settings do not match their expectations,"[173] Dr. King claims that "Google's internal documents (discussed above) suggest that users expect that disabling 'location history' would not mean that Google continues to collect and store location."[174] Dr. King does not specify which documents she refers to, but I am not aware of a scientific study conducted by Google, or otherwise, demonstrating that users had a certain expectation when they disabled LH *and* would have behaved differently in the absence of the alleged conduct at issue in this case.

69. Fourth, Dr. King claims that Google's default settings can create "a situation where a user must opt-out of data collection, rather than opt-in," which makes it difficult for users to avoid location data collection, because "defaults are 'sticky'—meaning, once they are set, users rarely change them."[175] but she does not provide any evidence that this is the case with Google's location privacy settings. Dr. King largely provides a hypothetical discussion and does not provide any empirical evidence or any scientific study or data of her own to show that users in Arizona have difficulties navigating, understanding, or remembering settings at issue in this case. The only piece of evidence she has to offer is a decision by an Australian court,[176] but I understand from counsel that the case was narrower than this case, no scientific evidence of user deception was presented to the court and, in any event, a court decision is not scientific evidence.

6. Dr. King's report also fails to establish that Google intended to deceive users as alleged or that the alleged deception occurred in connection with a sale or advertisement (not connected harm to Arizona users).

70. To the extent that Dr. King asserts that Google intended to deceive users or that the alleged deception was in connection with the sale or advertisement of merchandise, Dr. King offers no reliable support for such claims. For example, Dr. King has not provided any documents in which Google employees actually discussed that they intended to deceive or harm Arizona users in connection with a sale or advertisement. Another type of reliable support would be to show the effect on users of such an alleged intent to mislead. Dr. King could have carried out empirical studies or provided a reference to such a study that would demonstrate systematic misperceptions among users in Arizona driven by the alleged conduct at issue in this case and the likelihood of alternative purchasing behavior in the absence of such conduct. However, as discussed in detail in earlier sections of my report, Dr. King, instead relies on anecdotal or hypothetical

[173] King Report, p. 64.
[174] King Report, pp. 64-65. As other evidence for this argument, Dr. King offers a tweet by a senator. King Report, p. 65.
[175] King Report, p. 65.
[176] King Report, p. 66.

evidence and where she does reference systematic analyses, those studies are not related to alleged conduct at issue in this case.

IV. DR. GRAY'S CONCLUSIONS REGARDING GOOGLE'S LOCATION COLLECTION PRACTICES CONTAINING "DARK PATTERNS" ARE UNSUPPORTED BY A RELIABLE METHODOLOGY

71. Dr. Gray's primary conclusion in his report are (1) "Google's internal documents show that Google has been on notice for many years that its settings are confusing and deceptive to users"; (2) "Google's UI and related location collecting practices contain specific dark patterns"; and (3) "connecting Google's use of dark patterns to business goals."

72. Dr. Gray provides no rigorous methodology or empirical support for any of his assertions beyond his own say-so. This is not consistent with scientific methodology practiced in the social sciences or in peer-reviewed literature (e.g., see academic studies I refer to in **Section II** above and the discussion of the appropriate methodology to identify causal relationships in **Section III**). Social scientists do not typically consider the subjective analysis of a single person (no matter their education or experience) to constitute a reliable methodology in order to reach conclusions about consumer understanding and behavior related to privacy. That is because, as prior published research on privacy policies demonstrates, even trained readers and "experts" can interpret privacy policies in different ways. One of these academic papers explains this:[177]

> For this research, we recruited a group of law and public policy graduate students … and presented these law and policy researchers with a set of privacy policies from companies in the e-commerce and news and entertainment industries. We asked them nine basic questions about the policies' statements regarding data collection, data use, and retention. We then presented the same set of policies to a group of privacy experts and to a group of crowd workers representing typical Internet users. The findings show areas of common understanding across all groups for certain data collection and deletion practices, but also demonstrate very important discrepancies in the interpretation of privacy policy language, particularly with respect to data sharing. The discordant interpretations arose both within groups and between the experts and the two other groups.

73. Here, Dr. Gray's conclusion that Google's location collection practices contain "dark patterns," should have been supported by scientific methods in order to first establish that "dark patterns" exist, and then to connect Google's alleged conduct at issue in this case as the cause of "dark patterns." But Dr. Gray has not used scientific methods of any kind and therefore has failed to support his conclusions in

[177] Joel R. Reidenberg, Travis Breaux, Lorrie Faith Cranor, Brian French, Amanda Grannis, James T. Graves, Fei Liu, Aleecia McDonald, Thomas B. Norton, Rohan Ramanath, N. Cameron Russell, Norman Sadeh, and Florian Schaub (2015) "Disagreeable Privacy Policies: Mismatches Between Meaning and Users' Understanding," *Berkeley Technology Law Journal*, 30:39-88, http://dx.doi.org/10.2139/ssrn.2418297, p. 40.

any rigorous or reliable manner. Further, as discussed below, Dr. Gray cherry-picks quotes from Google documents he cites, ignoring Google's apparent motivation to improve user experience.

A. Dr. Gray's own academic papers purport to use systematic data collection and empirical analysis

74. In his own academic research, Dr. Gray at least attempts to use empirical methods that he fails to use in his expert report. For example, Dr. Gray references four papers in his report that describe his and his co-authors' use of systematic methods involving systematic dataset generation and empirical analysis of those datasets. While I have not been asked to opine on whether Dr. Gray established "dark patterns" in those other papers, Dr. Gray has not even attempted in his report to use methodologies and analyses he has previously utilized:

a. Dr. Gray's article titled "The Dark (Patterns) Side of UX Design" describes use of "content analysis of instances of dark patterns identified by designers and journalists"[178] supporting his findings of "one of the first widely used typologies of dark patterns beyond the basic types."[179] More specifically, the paper describes a "Corpus Generation" methodology (followed by "Analysis"), where "two researchers employed an exploratory and iterative process to collect [through various websites] artifacts related to the idea of dark patterns for a two month period."[180] Dr. Gray's academic publication appeared to involve application of a method to analyze the information to support his conclusions regarding "dark patterns." Dr. Gray's report in this matter, however, did not involve collecting data, inter-rater coding approach, or engaging in any kind of content analysis to evaluate to what degree, if any, participants were misled or to what degree the findings were representative of Arizona users.

b. Another article that Dr. Gray co-authored, titled "#darkpatterns: UX Practitioner Conversations About Ethical Design," at least attempted to include systematic methods to support conclusions regarding "dark patterns."[181] Dr. Gray and his authors used "content analysis" and performed a "thematic analysis" in their paper to support his conclusions

[178] Gray Report, p. 5.
[179] Gray Report, p. 5, referencing Colin M. Gray, Yubo Kou, Bryan Battles, Joseph Hoggatt, and Austin L. Toombs (2018) "The Dark (Patterns) Side of UX Design," *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, CHI '18(534):1-14, https://doi.org/10.1145/3173574.3174108, ("Gray et al. (2018)").
[180] Gray et al. (2018), pp. 3-4.
[181] Gray Report, p. 39; Madison Fansher, Shruthi Sai Chivukula, and Colin M. Gray (2018) "#darkpatterns: UX Practitioner Conversations About Ethical Design," *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*, LBW082:1-6, https://doi.org/10.1145/3170427.3188553, ("Fansher et al. (2018)").

regarding "dark patterns."[182] In contrast, Dr. Gray did not apply such methods in drawing his conclusions in his report in this matter.

c. Another article that Dr. Gray co-authored also describes "Data Collection" and "Data Analysis" used to support conclusions. The authors "acknowledge the subjective positions from which our readings of each consent banner emerges" and that they did not seek "to reach objective and final consensus."[183] While I agree with the authors that this type of data collection and analysis is subjective, they at least attempted to apply a systematic method to support their conclusions, which Dr. Gray failed to do in his report in this matter.

d. In another academic paper, Dr. Gray conducted a survey to report on the "end users' felt experiences of manipulative products."[184] However, in the current matter, Dr. Gray has not conducted a survey or a single interview (or any other empirical research) to support the conclusions in his report.

75. Of note, many of Dr. Gray's opinions involve the words "may" and "could,"[185] which is at best a hypothesis, not a tested outcome.

B. Other researchers use systematic methods of data collection and empirical analysis to attempt to determine "dark patterns" but also caution that the current "dark patterns" literature relies on a shaky foundation that these methods cannot solve for

76. Based on my review of the "dark patterns" literature, I find that "dark patterns" researchers recognize that determination of "dark patterns" can be "subjective," particularly so in establishing deception and intent, if any. While some "dark patterns" researchers have used systematic methods of data collection and statistical analysis in drawing conclusions regarding "dark patterns," even the application of

[182] Fansher et al. (2018), p. 3.
[183] Colin M. Gray, Cristiana Santos, Nataliia Bielova, Michael Toth, and Damian Clifford (2021) "Dark Patterns and the Legal Requirements of Consent Banners: An Interaction Criticism Perspective," *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, CHI '21(172):1-18, https://doi.org/10.1145/3411764.3445779, ("Gray et al. (2021)"), pp. 4, 6. Dr. Gray references this article in his report, footnote 31 and p. 40.
[184] Colin M. Gray, Jingle Chen, Shruthi Sai Chivukula, and Liyang Qu (2021) "End User Accounts of Dark Patterns as Felt Manipulation," *Proceedings of the ACM on Human-Computer Interaction,* 5(CSCW2)(372):1-25, https://doi.org/10.1145/3479516, p. 1.
[185] For example, Dr. Gray states that "This pre-selection […] **could** also be the dark pattern strategy sneaking." Gray Report, p. 22, emphasis added, original emphasis removed. He also states that "This absence of all comprehensive location-related controls on this page […] **may** lead to the user concluding that all relevant location settings are on a settings page marked 'Location'" and "**may** result in the use of user location data in ways that are only realized through other means." Gray Report, pp. 22-23, emphasis added. *See also*, Gray Report, pp. 24, 28, 32, 33, 36.

systematic approaches cannot fully address the inherent subjectivity, nor can it cure the inconsistencies and "shaky foundation" that the extant dark patterns literature relies on.

77. Other "dark patterns" researchers, many cited by Dr. Gray in his report in this matter, have employed systematic methods, in some cases, to attempt to address the inherent subjectivity involved in the process of determining "dark patterns."

a. Mathur et al. (2019), which Dr. Gray cites in his report, applied a scientific method involving two researchers who would validate the coding of "dark patterns."[186] Specifically, the two researchers each examined a sample of "clusters" and "recorded any dark patterns they encountered."[187] The team then "discussed and resolved all disagreements, and one researcher then examined the remaining clusters in the same manner," after which the team then "discussed the resulting dark patterns, and iteratively grouped them into types and broader categories."[188]

b. In a subsequent paper, Mathur et al. (2021),[189] which Dr. Gray also cites throughout his report, summarize and attempt to synthesize the extant literature on dark patterns. The authors ultimately conclude that the current academic discourse about dark patterns is "built on a shaky foundation."[190] Mathur et al. (2021) claim that, although the literature has "rich descriptive contributions," the "contours and normative underpinnings of dark patterns have received less attention,"[191] and that the literature "currently lacks a clear and consistent conceptual foundation."[192] Furthermore, Mathur et al. (2021) provide a detailed discussion of the different inconsistencies with which the current dark patterns research is riddled. This includes the "diverse range of definitions" used by dark patterns researchers, which they argue "sharply illustrates the lack of conceptual consistency in prior work."[193]

[186] Arunesh Mathur, Gunes Acar, Michael J. Friedman, Eli Lucherini, Jonathan Mayer, Marshini Chetty, and Arvind Narayanan (2019) "Dark Patterns at Scale: Findings from a Crawl of 11K Shopping Websites," *Proceedings of the ACM on Human-Computer Interaction*, 3(CSCW)(81):1-32, https://doi.org/10.1145/3359183, ("Mathur et al. (2019)"), p. 11.
[187] Mathur et al. (2019), p. 11.
[188] Mathur et al. (2019), p. 11.
[189] Arunesh Mathur, Jonathan Mayer, and Mihir Kshirsagar (2021) "What Makes a Dark Pattern... Dark?: Design Attributes, Normative Considerations, and Measurement Methods," *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, CHI '21(360):1-18, https://doi.org/10.1145/3411764.3445610, ("Mathur et al. (2021)").
[190] Mathur et al. (2021), p. 1.
[191] Mathur et al. (2021), pp. 1-2.
[192] Mathur et al. (2021), p. 7.
[193] Mathur et al. (2021), p. 7.

c. The authors note that some of the definitions used "provide that a dark pattern must be misleading."[194] However, they argue that there is "nothing inherently misleading about many of the dark patterns described in the literature."[195] Importantly, two examples of such dark patterns are Gray et al. (2018)'s Forced Action dark pattern, as well as Mathur et al. (2019)'s Obstruction dark pattern.[196] But Mathur et al. (2021) explicitly states that interface designs that this literature labels "Forced Action" and "Obstruction" "can be entirely truthful with users."[197] Mathur et al. (2021) also acknowledge that critics have pointed out that "all marketing involves shaping user preferences to varying degrees," which implies that "this lens says little about how we can distinguish benign or tolerable practices from ones that deserve sanction."[198] Mathur et al. (2021) explains that the difficulty in describing the "baseline standard we should have in mind when examining potential dark patterns" is attributable to the fact that individual preferences and desires are "difficult to measure for a variety of reasons, including because they are unstable, vary across individuals, and may require large-scale measurement."[199] This statement also is consistent with the findings from the economics of privacy literature (discussed in **Section II.A**) with regard to user heterogeneity in privacy preferences and choices.

d. Di Geronimo et al. (2020), also cited by Dr. Gray in his report, employed a systematic method involving three people to classify instances of dark patterns in apps.[200] Any disagreements "were noted for later analysis; these cases were then discussed with a third researcher, also knowledgeable about Dark Patterns," and "[t]he final decision on the classification was taken by majority voting."[201] Furthermore, Di Geronimo et al. (2020), in addition to Mathur et al. (2021), seem to provide further support that users are heterogenous

[194] Mathur et al. (2021), p. 7.
[195] Mathur et al. (2021), p. 7.
[196] Mathur et al. (2021), p. 7.
[197] Mathur et al. (2021), p. 7.
[198] Mathur et al. (2021), p. 15. Mathur et al. (2021) further call into question the alleged deceptiveness of one of Dr. Gray's dark patterns—nagging: "Gray et al. define dark patterns as 'deceptive functionality.' But there is nothing inherently deceptive about the paper's Nagging dark pattern." Mathur et al. (2021), p. 7. I note that Dr. Gray does not label any of Google's settings as "nagging," he only references another paper that has labeled Google's Location Services as "nagging" perhaps because of Mathur et al. (2021)'s comment. In particular, the only mention of nagging in Dr. Gray's report is as follows, "For instance, in Hung (2021), the Google Location Services example from our corpus is used as an example of 'nagging.'" Gray Report, p. 8.
[199] Mathur et al. (2021), p. 15.
[200] Linda Di Geronimo, Larissa Braz, Enrico Fregnan, Fabio Palomba, and Alberto Bacchelli (2020) "UI Dark Patterns and Where to Find Them: A Study on Mobile Applications and User Perception," *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, CHI '20(473):1-14, http://dx.doi.org/10.1145/3313831.3376600, ("Di Geronimo et al. (2020)"), p. 4.
[201] Di Geronimo et al. (2020), p. 4.

in their preferences (see **Section II.A** above), suggesting that not all users may view all dark patterns as dark.[202] Di Geronimo et al. (2020) acknowledge that determining intent of the designer is subjective and problematic.[203] Dr. Gray, however, appears to conclude in his report that "dark patterns" are "intentionally designed to deceive users,"[204] He also states in his academic research that these are patterns where "malice is assumed."[205]

e. Other researchers appear to agree with Di Geronimo et al. (2020)'s statements that ill-intent cannot always be assumed or inferred. Gunawan et al. (2021) describe use of a scientific method to determine "dark patterns" using initial labeling which was "performed independently by the first author of this paper," which then was validated by a second researcher "independently label[ing] a subset of the services from our corpus."[206] Importantly, Gunawan et al. (2021)'s methodology for identifying "dark patterns" "did not consider designer intent,"[207] recognizing that "even the best designs can result in unintended outcomes."[208] In fact, in their examination of dark patterns, Gunawan et al. (2021) used a similar approach as Di Geronimo et al. (2020) and judged "services solely by what was presented in the UI and whether the design privileged the service or the user, rather than attempting to infer whether designers had ill-intent."[209] Gunawan et al. (2021) also discuss the evolving discourse on determining what is and is not a dark pattern, and approaches to establish them. For example, after employing a similar stance and analytical method as Di Geronimo et al. (2020), Gunawan et al. (2021) observed "several disparities between our results and those from Di Geronimo et al."[210] Gunawan et al. (2021) concluded that the "comparative results highlight that the work of identifying dark patterns is complicated by the evolving discourse around what is and is not a dark pattern, and how to systematize these

[202] For example, Di Geronimo et al. (2020) state that "[d]efining an interface as a Dark Pattern can be open to interpretations; for example, asking a mobile app user to invite their friends in order to receive some in-app bonuses may seem inappropriate to some users but a legitimate business decision to others." Di Geronimo et al. (2020), p. 1, citations omitted.
[203] For example, Di Geronimo et al. (2020) state that: "Understanding designers' intentions and ethical decisions is subjective and may lead to imprecision…. For instance, if an app asks for location permissions and the UI seems to prefer the 'accept' option, we consider it as a malicious design (False Hierarchy in this case), even though the designers may have intended this feature to speed up the interaction process." Di Geronimo et al. (2020) p. 4.
[204] Gray Report, p. 15.
[205] Gray et al. (2018), p. 9.
[206] Johanna Gunawan, Amogh Pradeep, David Choffnes, Woodrow Hartzog, and Christo Wilson (2021) "A Comparative Study of Dark Patterns Across Mobile and Web Modalities," *Proceedings of the ACM on Human-Computer Interaction,* 5(CSCW2)(377):1-29, https://doi.org/10.1145/3479521, ("Gunawan et al. (2021)"), p. 12.
[207] Gunawan et al. (2021), p. 7.
[208] Gunawan et al. (2021), p. 22.
[209] Gunawan et al. (2021), p. 7.
[210] Gunawan et al. (2021), p. 18.

patterns into a coherent taxonomy."[211]

f. Dreyer et al. (2022) "carried out a systematic analysis of 40 popular location-based services," in which "Two independent raters assessed each app regarding the content, structure and design of its informed consent dialogues [including assessments of dark patterns]."[212] They noted that, because their analysis-framework relies at least "partly on subjective interpretations," the two raters informally discussed "their schemes in order to synchronize the applied ratings."[213] The authors found that several of the apps from Google rank favorably compared with the others in the set of "40 popular location-based," apps.[214] For example, for Google Maps, the authors found no occurrence of "Forced Action," "Sneaking," or "Nagging" across four different measures.[215]

78. In summary, while some researchers in the "dark patterns" literature have employed systematic methods, they recognize the inherent subjectivity involved and assumptions required to determine "dark patterns." Some of them have even called into question the conceptual foundations of the "dark patterns" literature. That is, even when systematic methods of data collection and empirical analysis are used, the current "dark patterns" literature does not provide a reliable and replicable foundation for Dr. Gray's conclusions. As discussed in more detail below, Dr. Gray (i) does not use any scientific methods in his report, (ii) does not recognize the subjectivity of his approach, and (iii) does not acknowledge that his peers have questioned the conceptual foundation of this literature.

C. Dr. Gray's conclusions that "Google's Internal Documents Show That Google Has Been on Notice for Many Years That Its Settings Are Confusing and Deceptive to Users" is unsupported and based on cherry-picked and misrepresented evidence

79. Dr. Gray contends that "Google Has Been on Notice for Many Years That Its Settings Are Confusing and Deceptive to Users."[216] Dr. Gray bases his conclusion on the documents that Google produced in this matter. Such a conclusion requires the use of a scientific method to determine whether Google's alleged conduct at issue in this case caused consumers to be misled or harmed, and if so, whether Google has been aware, or "on notice," about deceptive settings. However, none of the sources Dr. Gray cites

[211] Gunawan et al. (2021), p. 19.
[212] Jerome Dreyer, Sven Heitmann, Felix Erdmann, Gernot Bauer, and Christian Kray (2022) "'Informed' consent in popular location based services and digital sovereignty," *Journal of Location Based Services,* https://doi.org/10.1080/17489725.2021.2017495, ("Dreyer et al. (2022)"), pp. 2-3.
[213] Dreyer et al. (2022), p. 11.
[214] Dreyer et al. (2022), pp. 2, 30-31.
[215] Dreyer et al. (2022), p. 30.
[216] Gray Report, p. 10.

provides a scientific method to support alleged confusion, deception or being "on notice." The documents do not include an experiment, such as a study including test and control groups, that would quantify how many users had the allegedly mistaken perception, how many of them would have a different perception with a different set of settings, and how many of them would change their behavior as a result.

80. Instead, Dr. Gray only offers anecdotal evidence that he infers from Google's internal documents, which he splits into three sets: (i) a "go/ul2017,"[217] (ii) "Google's Internal Studies,"[218] and (iii) supposed evidence of employees' own confusion.[219] Contrary to Dr. Gray's conclusion, these documents do not offer any scientific analysis of consumer perceptions or Google employee perceptions. Dr. Gray cherry-picks quotes convenient for him, often misrepresenting their meaning, and ignores the larger context or portions of the documents that are more favorable to the Defendant than to Plaintiff.

81. In his discussion of the go/ul2017 document[220] and a related email exchange among Google employees,[221] Dr. Gray cherry-picks passages such as "overall mess," "crazy confusing," and "terribly complicated,"[222] but ignores the stated intent of the documents, which is to improve user experience and remove potential confusion.[223] The go/ul2017 document also reflects Google employees' perspectives that location data is "one of the most sensitive and vast personal signals that we collect from users" and that Google has "been very good and responsible with it," concluding that Google has "many products that benefit and delight users by taking advantage all the User Location data we collect(ed)."[224]

82. The related document that Dr. Gray cites is an email exchange among Google employees that acknowledges both the benefits that location data provides to users and the challenge of maintaining transparency.[225] Google's employees in this exchange appear to be trying to improve users' experience around location data collection and disclosure.[226]

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[217] Gray Report, p. 11.
[218] Gray Report, p. 11.
[219] Gray Report, p. 15.
[220] Following Dr. Gray's notation, I'll assume that this is the document GOOG-GLAZ-00317865, even though GOOG-GLAZ-00317865 does not contain the string "go/ul2017."
[221] GOOG-GLAZ-00057477.
[222] Gray Report, p. 11.
[223] The go/ul2017 document explains that "The overall direction that this doc proposes is to achieve better cohesion of the various use cases for data collection with our existing - and relatively well-understood - umbrellas of Location History and Web & App History. We also make room for emerging areas for data collection (e.g., Context-based notifications)." GOOG-GLAZ-00317865, p. 1.
[224] GOOG-GLAZ-00317865, p. 4.
[225] GOOG-GLAZ-00057477, referenced in Gray Report, p. 11.
[226] For example, one email states, "I believe users mostly expect that Google knows their precise location when they are using GMM or searching from a mobile device. Yet we often don't know where they are. How can we provide a good location for every user who wants it? How can we be clear and transparent when we don't know precisely

83. Neither the go/ul2017 document, nor the email exchange appear to discuss any systematic evaluation of perception, attitude (as described in **Section II.A**, users are heterogeneous in their concerns about privacy and as described in **Section II.B**, establishing those preferences is non-trivial), or behavior (as discussed in **Sections II.C-II.D**, consumers benefit from apps that use location data and targeted advertising based in part on location data, and thus would not necessarily change their behavior under alternative settings or disclosures) of relevant Arizona consumers (or systematic evaluation of any set of consumers). Further, Dr. Gray offers no evidence that the opinions expressed in the go/ul2017 document or the email exchange are representative of all Google employees. For example, he has not conducted a systematic content analysis of all Google employee emails with a set of relevant keywords or a survey of Google employees.

84. Dr. Gray also postulates that "Google has been aware for years that its location-related settings mislead users" and "these location settings were intentionally designed to deceive users."[227] He alternately argues that (i) "Google employees have been aware" that Google's alleged conduct at issue in this case supposedly "misleads users and deceives them," and (ii) Google employees were themselves confused.[228] Dr. Gray provides no reliable support for these conclusions. He has not conducted any empirical analysis to demonstrate or quantify any alleged confusion of Google employees or their alleged awareness of alleged consumer confusion.

85. Finally, Dr. Gray concludes that certain of Google's alleged conduct at issue in this case constitute "dark patterns." He terms these "dark patterns" as "obstruction" and "sneaking."[229] Dr. Gray provides no empirical evidence and this conclusion is not based on any methodology described in his report beyond his say so. Moreover, there is no agreement even among researchers of the dark patterns whether all of them constitute deception. For example, according to a recent paper, which Dr. Gray repeatedly cites in his report, "Combining the diverse range of dark pattern taxonomies and types with the diverse range of definitions sharply illustrates the lack of conceptual consistency in prior work. The Bösch et al. and CNIL definitions, for example, provide that a dark pattern must be misleading. But there is nothing inherently misleading about many of the dark patterns described in the literature, such as Conti and Sobiesk's Coercion and Forced Work patterns, Gray et al.'s Forced Action dark pattern, or Mathur et al.'s Obstruction pattern. These user interface designs can be entirely truthful with users."[230]

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where they are? How can we do a great job of respecting people's privacy when they don't want to share their location." GOOG-GLAZ-00057477 at 478.

[227] Gray Report, p. 15.

[228] Gray Report, p. 15.

[229] Gray Report, p. 16, emphasis removed.

[230] Mathur et al. (2021), p. 7, references omitted.

86. I understand from counsel that another expert retained by Google, Dr. Joel Steckel, has opined that Dr. Gray's conclusions regarding Google's internal studies are similarly unsupported.

D. Dr. Gray's conclusions that "Google's UI and Related Location Collecting Practices Contain Specific Dark Patterns" is not based on scientific evidence and is therefore unsupported

87. Dr. Gray claims to demonstrate that "UI elements that users rely upon to alter a range of location settings have included specific dark patterns that impact users' ability to make an informed and educated decision."[231] To support this causal assertion, Dr. Gray does not use any experimental methods, does not aggregate a dataset of user perceptions or behaviors, and does not conduct any systematic analysis. Instead, he cherry-picks quotes from email exchanges among Google employees and from Google internal presentations, references supposed results of Google studies without any insights into what the methodology or actual outcome was, and simply labels Android "task flows" with various "dark pattern" types without any systematic evidence. Dr. Gray also ignores that the internal documents he cites demonstrate Google's apparent motivation to improve user experience. I address Dr. Gray's conclusions below.

88. Dr. Gray first discusses Google's reaction to an August 13, 2018 AP article titled "Google tracks your movements, like it or not." Dr. Gray relies on internal documents for his discussion.[232] Dr. Gray claims that the statement on the "Google's Location History Help Center Page '*With Location History off, the places you go are no longer stored*,'"[233] present on Google's Location History Help Center page prior to the article was "incorrect" and deceptive.[234]

89. Dr. Gray provides no empirical evidence or scientific evaluation of the extent, if any, to which Arizona users were sufficiently concerned with privacy to get themselves exposed to the "incorrect" statement (e.g., as described in **Section II.A**, users are far from homogenous in their concerns about privacy and as described in **Section II.B**, establishing those preferences is non-trivial), took away a particular perception from it, would have taken another perception from a different version of the statement (or from Google doing something that would "address the heart of the problem" in his opinion), or would have changed their behavior as a result (e.g., as discussed in **Sections II.C-II.D**, consumers

[231] Gray Report, p. 17.
[232] Gray Report, pp. 17-19.
[233] Gray Report, pp. 17-19, emphasis in original.
[234] Gray Report, p. 17-19. For example, Dr. Gray cites the following statement by a Google employee: "our messaging around this is enough to confuse a privacy focused Google-SWE." Gray Report, p. 18, emphasis removed.

benefit from location tracking and targeted advertising based in part on location data). For instance, Dr. Gray does not offer any quantitative analyses regarding how many users ever saw the language in question, how many users were deceived by it, how many users enabled or disabled Location History, and whether users presented with different language or settings would have changed their behavior, among others. Without any scientific evidence in any of these relevant measures, Dr. Gray's conclusions are completely unsupported.

90. For example, Dr. Gray claims that "the user interface to control location settings is deceptive and misleading."[235] He bases his conclusions on several types of evidence including an "analysis" of "key task flows relating to a subset of these location settings" (screenshots from screens that an Android user would see when navigating WAA settings from their Google Account), which he classifies by the type of "dark pattern" that it supposedly represents.[236] The "analysis" does not involve any systematic data collection and a systematic analysis of such a data set as Dr. Gray did in his academic work (see **Section IV.A** above). Instead, he simply names certain use cases "confusing" or using "dark patterns," including specific "dark patterns" such as "sneaking" or "forced action."[237] Tellingly, he repeatedly quotes a paper, (Mathur et al. (2021)) that actually suggests that "forced action" is not necessarily "misleading" (see **Section IV.B** above).

91. Further, in the documents he cites, Dr. Gray ignores Google's apparent motivation to improve user experience. For example, he states that the "motivation for collecting more precise user location data in 2014 or 2015 was, at least in part, the desire to 'increase[e] the accuracy of locations served on Search and Ads, in turn **improving the search experience** and increasing Ads revenue.'"[238] Despite including this quote from an email from a Google employee in his report, Dr. Gray seems to ignore one of the key Google motivations—the same email also mentions that the "launch the of [sic] fine grained location data on Footprints" would "**Increase[] user transparency and control over location data** stored with Google via new fine grained location annotations on history.google.com."[239]

92. Dr. Gray further cherry-picks from the documents by omitting portions that are unfavorable to his argument. For example, to support the statement that [redacted] Dr. Gray cites, among others, a

[235] Gray Report, p. 19.
[236] Gray Report, p. 21.
[237] Gray Report, pp. 21-22, emphasis removed.
[238] Gray Report, p. 21, referencing GOOG-GLAZ-00106193 at 194, emphasis added.
[239] GOOG-GLAZ-00106193 at 193, emphasis added.

document titled "Location Preferences and Settings."[240] Dr. Gray does not address the statement in the same document that "Battery is main reason users turn Location Off."[241]

93. Next, Dr. Gray claims that the Google Account Set Up contains "dark patterns," because, for example, to learn that "WAA is related to location tracking," he claims a user has to click on "More Options," scroll to "Web & App Activity," and click on "Learn more."[242] Dr. Gray describes this and other examples, and then labels them as various "dark patterns strategies" including "sneaking," "interface interference," and "obstruction."[243]

94. Dr. Gray provides no systematic analysis or scientific evidence to support his opinion that users are concerned about WAA or location settings more generally, seek out the settings that are supposedly hidden from them, or would change their perceptions or behavior if the settings were changed. The only piece of supposed evidence he offers with respect to users' attitudes or behaviors is a "high-level view" point from a Google presentation.[244] Further, the presentation provides only three data points, which are open-ended responses apparently from three participants to a Google survey, to support his point.[245] The document includes numerous quantifications of the survey results, but the only page that Dr. Gray quotes offers no quantifications of results.[246]

95. Further, Dr. Gray fails to account for the fact that Google is more widely-used than many other location-based services platforms, and that its users employ a variety of different features across a variety of different products on the platform.[247] Indeed, prior academic research has recognized that "privacy policies of large companies may cover multiple services, websites, apps, and even physical stores; such policies are often crafted by legal teams and frequently updated. Privacy Policies of smaller or less

[240] Gray Report, p. 17. Referencing GOOG-GLAZ-00029585.
[241] GOOG-GLAZ-00029585 at 608. Specifically, in a 2017 survey, of [redacted] in response to the question [redacted] GOOG-GLAZ-00029585 at 647.
[242] Gray Report, p. 23.
[243] Gray Report, p. 23-24, emphasis removed.
[244] Stating that [redacted] Gray Report, p. 25, emphasis in original, referencing GOOG-GLAZ-00078009 at 037.
[245] The document that Dr. Gray cites describes a survey of [redacted] GOOG-GLAZ-00078009 at 009, 012-013.
[246] Gray Report, p. 25, referencing GOOG-GLAZ-00078009 at 037.
[247] Statista (2022) "Most popular multi-platform web properties in the United States in January 2022, based on number of unique visitors," https://www.statista.com/statistics/271412/most-visited-us-web-properties-based-on-number-of-visitors/.

popular companies may have narrower focus or vary in employed language, and they may be updated less frequently."[248] Nevertheless, for his report in this case, Dr. Gray fails to account for such differences in evaluating Google' user setting and privacy policies. Also contrary to Dr. Gray's opinion, the Center for Plain Language evaluated the privacy policies of seven technology companies: Apple, Facebook, Google, LinkedIn, Lyft, Twitter, and Uber.[249] The Center found that: "Google and Facebook do a good job of communicating their privacy policies in a way that allows consumers to understand and make decisions – at least motivated consumers."[250]

96. The presentation that Dr. Gray cites addresses user heterogeneity, stating that the presented research was performed to "Understand[] priorities of different user groups [which] helps us to integrate segmentation/personalization," and includes results based on different segments of the user base.[251] The study authors conclude, "Privacy-sensitive users are more interested in Security, what data Google collects and how to control their data."[252] These findings reflect my discussion in **Section II.A** that users are heterogeneous in their concerns about privacy. Dr. Gray fails to account for such differences in evaluating the Google Account Set Up and privacy policy.

97. Dr. Gray continues in this manner throughout the rest of his section VIII, labeling other Google UI and practices with various dark pattern labels without offering any scientific evidence or even any systematic analysis to support those claims, while cherry-picking materials he references and passages he quotes. For example, he repeatedly cites Mathur et. al (2021) as support for definitions of various "dark patterns" but omits the statement in the same academic paper that there is "nothing inherently misleading" about "Forced Action" and "Obstruction."[253]

[248] Shomir Wilson, Florian Schaub, Aswarth Abhilash Dara, Frederick Liu, Sushain Cherivirala, Pedro Giovanni Leon, Mads Schaarup Andersen, Sebastian Zimmeck, Kathashree Mysore Sathyendra, N. Cameron Russell, Thomas B. Norton, Eduard Hovy, Joel Reidenberg, and Norman Sadeh (2016) "The Creation and Analysis of a Website Privacy Policy Corpus," *Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics,* 1330-1340, pp. 1331-1332.
[249] Katy Steinmetz (2015) "These Companies Have the Best (And Worst) Privacy Policies," *Time,* https://time.com/3986016/google-facebook-twitter-privacy-policies/, referencing Center for Plain Language (2015) "Privacy-policy analysis," https://centerforplainlanguage.org/wp-content/uploads/2016/11/TIME-privacy-policy-analysis-report.pdf ("Center for Plain Language (2015)").
[250] Center for Plain Language (2015), p. 1.
[251] GOOG-GLAZ-00078009 at 012, 043-046.
[252] GOOG-GLAZ-00078009 at 045.
[253] Mathur et al. (2021), p. 7. Dr. Gray quotes this paper on pp. 22-26, 28, 31-33, 35-36 of his report.

E. Dr. Gray's conclusion that "Google's Use of Dark Patterns" is Connected to Business Goals" is not based on scientific evidence and is unsupported

98. In this section, Dr. Gray claims that Google used "dark patterns" to increase attach rates, and ultimately increase advertising revenues.[254] Dr. Gray specifically claims that Google engaged in "sneaking, interference interface, obstruction and forced action."[255]

99. Dr. Gray's conclusion that Google engaged in "dark patterns" that are "connected to business goals" is unsupported by scientific evidence. He cites a variety of email exchanges among Google employees and Google internal presentations. And he cites only anecdotal evidence suggesting that Google set a business goal to increase "attach rates." His evaluation of this point, like the others in his report, is not based on scientific evidence that is needed to draw a causal conclusion. As another example, Google's goals to improve user experience are discussed throughout Google's documents and should have been controlled for in Dr. Gray's analysis in order to remove the confounding effect of this goal from any supposed goal to increase attach rates to have a resulting increase in revenues. Examples of such statements are included throughout **Section IV** of my report and in the next paragraph.[256]

100. As in other sections of his report, Dr. Gray cherry-picks evidence to support his claims (including ignoring evidence of Google's goals and efforts to improve user experience).

a. In one document that Dr. Gray cites, he focuses on the statement [redacted][257] ignoring that the document opens with the following statement demonstrating Google's desire and continued effort for a great user experience, "[redacted] is a critical signal for Search Quality. It is impossible to give good results for queries like [starbucks] or [dentist] without knowing where the user is. Our

[254] Gray Report, pp. 36-38.
[255] Gray Report, pp. 36-38, emphasis removed.
[256] For example, as discussed above, The go/ul2017 document addressed in detail by Dr. Gray explains that "[t]he overall direction that this doc proposes is to achieve better cohesion of the various use cases for data collection with our existing - and relatively well-understood - umbrellas of Location History and Web & App History. We also make room for emerging areas for data collection (e.g., Context-based notifications)." GOOG-GLAZ-00317865, p. 1. As also discussed above, one of the related emails states, "I believe users mostly expect that Google knows their precise location when they are using GMM or searching from a mobile device. Yet we often don't know where they are. How can we provide a good location for every user who wants it? How can we be clear and transparent when we don't know precisely where they are? How can we do a great job of respecting people's privacy when they don't want to share their location." GOOG-GLAZ-00057477 at 478.
As another example, also as discussed above, Dr. Gray himself points quotes the following statement in a Google document "motivation for collecting more precise user location data in 2014 or 2015 was, at least in part, the desire to 'increase[e] the accuracy of locations served on Search and Ads, in turn **improving the search experience** and increasing Ads revenue.'" Gray Report, p. 21, referencing GOOG-GLAZ-00106193 at 194, emphasis added.
[257] Gray Report, p. 36, referencing GOOG-GLAZ-00224777 at 778.

signal has a significant impact on about [redacted] of all web queries. I have spent the last two years on improving the quality of location and how it is used in search. I improved the ability to measure and evaluate the use of location in search. I have added new signals for locations ([redacted]), improved existing ones ([redacted]), and come up with new ways of using them in ranking ([redacted]).'"[258] This statement precedes any discussion of revenue.

b. In another document Dr. Gray cites, he focuses on statements [redacted][259] ignoring statements (i) "The past two studies we've done show that the top reason why users turn device location off are [sic] due to battery. Second is usually privacy" and (ii) "Full-on Location History isn't desired by all: there is a **critical mass of apps that need something else from us**."[260]

c. In two documents Dr. Gray references to support the statement that "user location data is used in the vast majority of Google advertisements,"[261] he ignores statements that show Google's continued efforts related to improving user experience such as goals to "Minimize data usage" and "Improve transparency and management tools" in one document[262] and in the other: "Only coarse location is allowed to target," "When the location is more granular than this, it needs to be blown up or anonymized to this level," and "Give user transparency and control to out-out [sic] the use of personal information."[263]

F. Dr. Gray's report also fails to establish that Google intended to deceive users as alleged or that the alleged deception occurred in connection with a sale or advertisement

101. To the extent that Dr. Gray asserts that Google intended to deceive users or that the alleged deception was in connection with the sale or advertisement of merchandise, Dr. Gray offers no reliable support for such claims. For example, Dr. Gray has not provided any documents in which Google employees actually discussed that they were planning to mislead users. Another type of reliable support would be to show the effect on users of such an alleged intent to mislead. Dr. Gray could have carried out

[258] GOOG-GLAZ-00224777 at 777, brackets in original.
[259] Gray Report, p. 37, referencing GOOG-GLAZ-00027795 at 805, emphasis in original.
[260] GOOG-GLAZ-00027795 at 798, 802, emphasis in original.
[261] Gray Report, p. 37, referencing GOOG-GLAZ-00249475 at 476, GOOG-GLAZ-00166095 at 115. Gray report references "GOOG-GLAZ-000249475 [sic]."
[262] GOOG-GLAZ-00166095 at 126, emphasis removed.
[263] GOOG-GLAZ-00249475 at 489.

empirical studies or provided a reference to such a study that would demonstrate systematic misperceptions among users in Arizona or the U.S. driven by the alleged conduct at issue in this case and the likelihood of alternative behavior in the absence of such conduct. However, as discussed in detail in earlier sections of my report, Dr. Gray, instead relies on anecdotal evidence, and where he does reference systematic analyses, he either cherry-picks statements he cites or offers no evidence that those studies pertain to users in Arizona or the U.S.

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June 8, 2022

Appendix A

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ACADEMIC EXPERIENCE

5/2017 – Present	**NYU Stern School of Business** Heinz Riehl Chair Professor of Business
5/2013 – 4/2017	**NYU Stern School of Business** Professor of Technology, Operations, and Statistics and Professor of Marketing NEC Faculty Fellow
4/2017 – Present	**NYU Stern School of Business** Director, Masters of Business Analytics (MSBA) Program
5/2016 – Present	**NYU Stern School of Business** Co-Director, Masters of Business Analytics (MSBA) Capstone
2/2016 – Present	**NYU Stern School of Business** Stern Faculty Scholar
8/2012 – 4/2017	**NYU Stern School of Business** Director, Center for Business Analytics (CBA)
9/2013 – 12/2014	**NYU** Co-Chair, NYU-AIG Partnership on Innovation for Global Resilience
5/2010 – 4/2013	**NYU Stern School of Business** Associate Professor (with tenure) Robert L. & Dale Atkins Rosen Faculty Fellow Daniel Paduano Fellow
8/2011 – 7/2012	**Wharton School of Business, University of Pennsylvania** Visiting Professor
1/2011 – 6/2012	**NYU Stern School of Business** Co-Director, Center for Digital Economy Research (CeDER)
9/2004 – 4/2010	**NYU Stern School of Business** Assistant Professor

EDUCATION

2004	**Tepper School of Business, Carnegie Mellon University** Ph.D. Information Systems
2002	**Tepper School of Business, Carnegie Mellon University** M.S. Information Systems
1998	**Indian Institute of Management, Calcutta** M.B.A. Finance, Marketing, & Information Systems
1996	**Regional Engineering College, (REC), Jalandhar, India** B.Tech. Instrumentation & Control Engineering

SELECTED ACADEMIC HONORS AND AWARDS

- **2021** Best Student Paper Award, International Conference on Information Systems (ICIS)
- **2021** Best Paper Runner Up Award, Information Systems Research (ISR)
- **2021** Nominated for CSWIM 2021 Best Paper Award
- **2020** INFORMS IS Practical Impact Award
- **2020** Best Paper Award Finalist, Management Science
- **2020** Appointment as Department Editor (IS) of Management Science
- **2019** Top 1% Highest Cited Researcher Recognition by Thomson Reuters
- **2019** Best Paper Award, Workshop in Information Technology Systems (WITS)
- **2019** NYU Stern Schoolwide Distinguished Teaching Award
- **2018** Axiom Business Book Gold Award for TAP in Business Technology category
- **2018** Axiom Business Book Bronze Award for TAP in Economics category
- **2018** Nominated for Best Paper, INFORMS-CIST conference
- **2018** Nominated for Information Systems Research Best Paper Award
- **2017** Thinkers50 Distinguished Achievement Nomination (Digital Thinker Award)
- **2017** Thinkers50 Radar Award for Top 30 Management Thinkers Globally
- **2017** POMS Healthcare Best Student Paper Award Finalist
- **2016** Best Student Paper Award in Workshop on Health IT and Economics (WHITE)
- **2016** National Science Foundation EAGER Award
- **2015** Distinguished Fellow Award from INFORMS Information Systems Society.
- **2015** Nominated for Best Paper, INFORMS-CIST conference
- **2015** Best Paper Award in MIS Quarterly for 2015
- **2015** Best AIS Paper Award from Association of Information Systems
- **2015** NET Institute Grant
- **2015** Marketing Science Institute Award
- **2015** Adobe Faculty Research Award
- **2014** Best Paper Award in Management Science IS department from the last 3 years (2011-2013)
- **2014** Best Paper Award in Information Systems Research for 2014
- **2014** Best Overall Conference Paper Award, American Marketing Association Conference
- **2014** Best Digital Marketing Track Paper Award, American Marketing Association Conference
- **2014** Kauffman Foundation Grant
- **2014** Selected For "Top 40 under 40 Business School Professors Worldwide" by Poets & Quants
- **2014** Selected For "Top 200 Thought Leaders in Big Data and Business Analytics" by Analytics Week
- **2013** Google Faculty Research Award
- **2012** Best Theme Paper Award, International Conference on Information Systems (ICIS)

- **2012** Marketing Science Institute Award
- **2012** SEI-Wharton Future of Advertising Grant
- **2012** Institute on Asian Consumer Insights Award
- **2012** Google Faculty Research Award
- **2012** NET Institute Grant
- **2012** NYU Abu Dhabi Institute Seed Grant
- **2011** Best Paper Award, Workshop on Health IT and Economics (WHITE)
- **2011** Daniel P. Paduano Fellowship at NYU Stern
- **2011** Delphi Big Think Fellowship
- **2011** Best Paper Award, 20th International World Wide Web Conference (WWW)
- **2011** Marketing Science Institute Young Scholar
- **2011** NYU Abu Dhabi Institute Seed Grant
- **2010** Google-WPP Marketing Research Award
- **2010** National Science Foundation IGERT Award
- **2010** MSI-Wharton Interactive Media Initiative (WIMI) Award
- **2009** Meritorious Service Award (Associate Editor) for Management Science.
- **2009** MSI-Wharton Interactive Media Initiative (WIMI) Award
- **2009** NYU-Poly Research Award
- **2009** National Science Foundation SFS Award
- **2009** NYU Stern Center for Japan-US Business and Economics Studies Grant
- **2008** Best Paper Award Nominee, Workshop on Information Technology and Systems (WITS)
- **2008** NET Institute Grant
- **2007** Best Track Paper Award (WISA) International Conference on Information Systems
- **2007** Best Paper Award Nominee International Conference on Information Systems
- **2007** Best Published Paper Runner Up Award in *Information Systems Research*
- **2007** Marketing Science Institute Award
- **2007** Microsoft Virtual Earth Award
- **2007** National Science Foundation CAREER Award
- **2006** Microsoft Live Labs Award
- **2006** NET Institute Grant
- **2005** ACM SIGMIS Doctoral Dissertation Award. (1st Runner-Up)
- **2005** Best Paper Award Nominee Hawaiian International Conference on System Sciences (HICSS)
- **2004** Best Paper Award Nominee, International Conference on Information Systems (ICIS)
- **2003** Doctoral Consortium Fellow, International Conference on Information Systems
- **2000** William Larimer Doctoral Fellowship at Carnegie Mellon University

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1. Fernandez, C, M. Cohen, and A. Ghose. 2022. Empirical Analysis of Referrals in Ride-Sharing**,** forthcoming, ***Information Systems Research.***
2. Sun, C., P. Adamopolous, A. Ghose, and X. Luo. 2021. Predicting Stages in the Consumer Path-Purchase Journey: An Omnichannel Deep-Learning Model, ***Information Systems Research***, November**.**
3. Ghose, A., X. Guo, B. Li, and Y. Dang. 2022. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, ***MIS Quarterly***, (46:1), 151-192.
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5. Xu, Y., M. Armony, and A Ghose. 2021. The Interplay between Online Reviews and Physician Demand: An Empirical Investigation, ***Management Science***, 67(12), 7344-7361.
   - **Finalist, 2017 POMS Healthcare Best Student Paper Award**
   - **Best Student Paper Award, 2016 Workshop on Health IT and Economics (WHITE)**
6. Cui, T, A. Ghose, H. Halaburda, R. Iyengar, K. Pauwels, S .Sriram, C. Tucker, and S. Venkataraman. 2020. Informational Challenges in Omnichannel Marketing: Remedies and Future Research, ***Journal of Marketing,*** 85(1), 103-120.
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   - **Nominated for INFORMS CIST 2018 Best Paper Award**
8. Todri, V, A. Ghose, and P. Singh. 2020. Trade-offs in Online Advertising: Modeling and Measuring Advertising Effectiveness and Annoyance Dynamics, ***Information Systems Research.*** 31 (1), 102-125.
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   - **Best Theme Paper Award at 2012 International Conference on Information Systems.**
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   - **Nominated for Best Paper Award in Information Systems Research**
16. Xu, K., J. Chan, Ghose, A., and S. Han. 2017. Battle of the Channels: Impact of Tablets on Digital Commerce, ***Management Science,*** 63 (5): 1469-1492.

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23. Ghose, A., and S. Han. 2014. Estimating Demand for Mobile Apps in the New Economy, ***Management Science,*** 60(6), 1470-1488.
24. Chan, J., and A. Ghose. 2014. Internet's Dirty Secret: Assessing the Impact of Online Intermediaries on HIV Transmission, ***MIS Quarterly, December,*** 38(4).
    - **Best Paper Award at the 2011 Workshop on Health IT and Economics**
    - **Best Paper Award in MIS Quarterly**
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25. Burtch, G., Ghose, A. and Wattal, S. 2013. The Impact of Online Privacy Controls on User Engagement: Evidence from a Randomized Experiment on a Crowdfunding Platform. ***INFORMS Annual Meeting, Minneapolis, MN.***
26. Burtch, G., Ghose, A., and Wattal, S. 2013. Secret Benefactors: Crowdfunder Information Hiding and its Implications for Fundraising Outcomes. ***INFORMS Conference on Information Systems and Technology (CIST), Minneapolis, MN.***
27. Burtch, G., Ghose, A., and Wattal, S. 2013. An Empirical Examination of the Antecedents and Consequences of Information Hiding in Crowdfunded Markets. ***INFORMS Marketing Science Conference, Istanbul, Turkey.***
28. Burtch, G., Ghose, A., and Wattal, S. 2013. An Empirical Examination of Online Information Hiding." 8th ***Symposium on Statistical Challenges in eCommerce Research (SCECR), Lisbon, Portugal.***
29. Burtch, G., Ghose, A. and Wattal, S. 2013. Cultural Differences and Geographic Proximity in Online Crowd-funding. ***International Symposium on Information Systems (ISIS), Goa, India***.
30. Chan, J., A. Ghose and R. Seamans. 2013. The Internet and Hate Crime. ***Workshop on Information Systems and Economics (WISE),*** **Milan, December.**
31. Ghose, A., S. Han and S. Park. 2013. Analyzing the Interdependence Between Web and Mobile Advertising, ***Marketing Science Conference,*** **Istanbul, July.**
32. Molitor, D., M. Spann and A. Ghose. 2013. Measuring the Effectiveness of Location Based Advertising. Randomized Field Experiments Comparing PC with Mobile, ***Marketing Science Conference,*** **Istanbul, July.**
33. Ghose, A., S. Han and S. Park. 2013. Analyzing the Interdependence Between Web and Mobile Advertising, ***Wharton Customer Analytics Conference,*** **Wharton School, May.**
34. Anindya Ghose, Panos Ipeirotis and Beibei Li. 2012. Surviving Social Media Overload: Predicting Consumer Footprints on Product Search Engines. ***Workshop on Information Systems and Economics (WISE),*** **Orlando, December.**
35. Chan, J. and A. Ghose. 2012. Internet's Dirty Secret: Assessing the Impact of Online Intermediaries on the Outbreaks of STDs, ***National Bureau of Economic Research Summer Meetings***, Boston.
36. Chan, J. and A. Ghose. 2012. Internet's Dirty Secret: Assessing the Impact of Online Intermediaries on the Outbreaks of STDs, ***Statistical Challenges in E-Commerce Research (SCECR)***, Montreal.
37. Ghose, A., and S. Han. 2012. Mobile Advertising and App Adoption in the New Mobile Economy, ***Statistical Challenges in E-Commerce Research (SCECR),*** Montreal.
38. Ghose, A., P. Ipeirotis, and B. Li. 2012. Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content, ***Research Frontiers in Marketing Science Conference,*** **University of Texas at Dallas, February.**
39. Ghose, A., P. Ipeirotis, and B. Li. 2011. Examining the Impact of Search Engine Ranking and Personalization on Consumer Behavior: Combining Bayesian Modeling with Randomized Field Experiments. ***Workshop on Information Systems and Economics (WISE),*** **Shanghai, December.**
40. Ghose, A., A. Goldfarb, and S. Han. 2011. How is the Mobile Internet Different? Search Costs and Local Activities***. Summer Institute of Competitive Strategy,*** **UC Berkeley, July.**
41. Ghose, A., A. Goldfarb, and S. Han. 2011 How is the Mobile Internet Different? Search Costs and Local Activities***. Searle Research Symposium on the Economics and Law of Internet Search,*** **Northwestern University, June.**

42. Ghose, A., A. Goldfarb, and S. Han. 2011. How is the Mobile Internet Different? Search Costs and Local Activities***. Statistical Challenges in E-Commerce Research (SCECR),*** **University of Arizona, June.**
43. Chan, J., A. Ghose. 2011. Examining the Antecedents and Consequences of Disclosing Medical Privacy Information Online. - ***Winter Conference on Business Intelligence,*** **University of Utah, Salt Lake City, March.**
44. Ghose, A., A. Goldfarb, and S. Han. 2010. Search Costs and Benefits on the Mobile Internet: An Empirical Analysis of Microblogging Behavior**.** ***Workshop on Information Systems and Economics (WISE),*** **St. Louis, December.**
45. Huang, Y., P. Singh, and A. Ghose. 2010. An Empirical Analyses of Dynamics in Enterprise Social Media. ***Workshop on Information Systems and Economics (WISE)*****, St. Louis, December.**
46. Ghose, A., P. Ipeirotis, and B. Li. 2010. Estimating Demand in the Hotel Industry by Mining User- Generated and Crowd-Sourced Content. ***NBER IT Economics & Productivity Workshop*****, Boston, July.**
47. Ghose, A. and S. Han. 2010. A Dynamic Structural Model of User Learning in Mobile Media Content. ***Stanford Institute of Theoretical Economics (SITE),*** **Stanford University, July**.
48. Ghose, A., P. Ipeirotis, and B. Li. 2010. Estimating Demand in the Hotel Industry by Mining User- Generated and Crowd-Sourced Content. ***Marketing Science Conference,*** **Cologne, June.**
49. Ghose, A., P. Ipeirotis, and B. Li 2010. Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content. ***Searle Research Symposium on the Economics and Law of Internet Search,*** **Northwestern University, June.**
50. Ghose, A., P. Ipeirotis, and B. Li. 2010. Estimating Demand in the Hotel Industry by Mining User- Generated and Crowd-Sourced Content. ***Customer Insights Conference,*** **Yale University, May.**
51. Ghose, A. and S. Han. 2009. A Dynamic Structural Model of User Learning in Mobile Media Content. ***MSI-WIMI Conference,*** **University of Pennsylvania, Philadelphia, December.**
52. Ghose, A. and S. Han. 2009. A Dynamic Structural Model of User Learning in Mobile Media Content, ***SIEPR-Microsoft Conference***, **Stanford University, September**.
53. Ghose, A. and S. Han. 2009. A Dynamic Structural Model of User Learning in Mobile Media Content. ***INFORMS Marketing Science Conference*****, Ann Arbor, Michigan, June.**
54. Combining Text mining with Econometrics: Monetization of User-Generated Content and Online Advertising. ***CITI Conference on User-Generated Content 3.0, Columbia University*****, April.**
55. Ghose, A., and S. Yang. 2009. Modeling and Estimating the Relationship Between Paid and Organic Search Advertising. ***Conference on the Economics of Software & Internet Industries*****, Toulouse, January.**
56. Ghose, A., and S. Yang. 2008. Organic vs. Paid Search Advertising. ***Workshop on Information Systems and Economics (WISE),*** **Paris, December.**
57. Ghose, A., and S. Yang. 2008. Modeling and Estimating the Relationship Between Paid and Organic Search Advertising. ***FTC and North-Western Microeconomics Conference,*** **Washington DC, November.**
58. The Dimensions of Reputation in Electronic Markets, ***INFORMS Annual Meeting,*** **Washington DC, October.**
59. Ghose, A. and S. Yang. 2008**.** An Empirical Analysis of Sponsored Search Performance in Search Engine Advertising. ***International Industrial Organization Conference*****, Washington DC, May.**
60. Ghose, A., and S. Yang. 2008. An Empirical Analysis of Sponsored Search Performance in Search Engine Advertising, ***Research Frontiers in Marketing Science Conference,*** **University of Texas at Dallas, February.**
61. Ghose, A., and S. Yang. 2008. An Empirical Analysis of Search Engine Advertising: Sponsored Search and Cross-Selling in Electronic Markets, ***Leveraging Online Media and Online Marketing,*** **Marketing Science Institute. February.**

62. Ghose, A., and S. Yang. 2007. An Empirical Analysis of Sponsored Search Performance in Search Engine Advertising, ***Workshop on Information Systems and Economics (WISE 2007),*** **December.**
63. Ghose, A., and P. Ipeirotis. 2007. Designing Novel Review Ranking Systems: Predicting Usefulness and Impact of Reviews. ***Proceedings of the Ninth International Conference on Electronic Commerce (ICEC),*** **Minnesota, August.**
64. Ghose, A., and S. Yang 2007. An Empirical Analysis of Paid Placement in Online Keyword Advertising. ***Proceedings of the Ninth International Conference on Electronic Commerce (ICEC),*** **Minnesota, August.**
65. Ghose, A., M. Smith, and R. Telang. 2007. Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Implications. ***Conference on Operational Excellence in Retailing,*** **Harvard Business School, June.**
66. Ghose, A., and P. Ipeirotis. 2007. Designing Novel Review Ranking Systems on the Web: Combining Economics with Opinion Mining. ***Third Research Symposium on Statistical Challenges in E- Commerce Research (SCECR),*** **University of Connecticut, May.**
67. Ghose, A., and O. Yao. 2007. Goodbye Price Dispersion? New Evidence from Transaction Prices in Electronic Markets. ***Third Research Symposium on Statistical Challenges in E-Commerce Research (SCECR),*** **University of Connecticut, May.**
68. Forman, C., A. Ghose and A. Goldfarb. 2007. Geography and Ecommerce: Measuring Convenience, Selection and Price. ***International Industrial Organization Conference,*** **Savannah, April.**
69. Archak, N., A. Ghose and P. Ipeirotis. 2007. Towards Automating the Pricing Power of Product Attributes: An Analysis of Online Product Reviews. ***Winter Business Intelligence Conference,*** **Utah, February.**
70. Forman, C., A. Ghose and A. Goldfarb. 2007. Geography and Ecommerce: Measuring Convenience, Selection and Price. ***DIS Workshop,*** **University of Florida, January.**
71. Ghose, A. and P. Ipeirotis. 2007. Designing Trusted Ranking Systems for Consumer Reviews: Combining Economics with Opinion Mining. ***DIMACS Workshop on Economics of Information Security,*** **Rutgers University, January.**
72. Ghose, A. and P. Ipeirotis. 2007. Designing Ranking Systems for Consumer Reviews: The Economic Impact of Customer Sentiment in Electronic Markets. ***Proceedings of the 2007 International Conference on Decision Support Systems (ICDSS 2007),*** **IIM Kolkata, January.**
73. Forman, C., A. Ghose and A. Goldfarb. 2007. Geography and Ecommerce: Measuring Convenience, Selection and Price. ***HICSS 20th Anniversary Symposium on Competitive Strategy, Economics, and Information Systems,*** **Hawaii, January.**
74. Ghose, A. and B. Gu. 2006. Estimating Menu Costs in Electronic Markets. ***International Symposium on Information Systems (ISIS 2006),*** **India, December.**
75. Ghose, A., P. Ipeirotis and A. Sundararajan. 2006. The Dimensions of Reputation in Electronic Markets. ***International Symposium on Information Systems (ISIS 2006),*** **India, December.**
76. Forman, C., A. Ghose and A. Goldfarb. 2006. The Impact of Geographical Location on Consumer Use of Electronic Markets. ***International Symposium on Information Systems (ISIS 2006),*** **India, December.**
77. Ghose, A. and B. Gu. 2006. Is Consumer Demand Kinked? Estimating Menu Costs and Search Costs in Electronic Markets. ***Workshop on Information Systems and Economics (WISE 2006),*** **Northwestern University, Evanston, December.**
78. Ghose, A., T. Mukhopadhyay, and U. Rajan. 2006. Impact of Internet Referral Services on the Supply Chain. ***INFORMS Annual Meeting,*** **Pittsburgh, Pennsylvania, November.**
79. Ghose, A. and B. Gu. 2006. Is Consumer Demand Kinked? Estimating Menu Costs and Search Costs in Electronic Markets. ***INFORMS Annual Meeting,*** **Pittsburgh, Pennsylvania, November.**
80. Ghose, A., K. Huang and A. Sundararajan 2006. Versions and Successive Generations: An Analysis of Product Line Strategies and Cannibalization in Software Markets. ***INFORMS Annual Meeting,*** **Pittsburgh, Pennsylvania, November.**

81. Ghose, A. and O. Yao. 2006. Price Dispersion on the Internet: New Evidence from Transaction Prices in B2B Electronic Markets. ***INFORMS Annual Meeting*****, Pittsburgh, Pennsylvania, November.**
82. Forman, C., A. Ghose and A. Goldfarb. 2006. The Impact of Location on Consumer Purchases in Electronic Markets. ***INFORMS Annual Meeting*****, Pittsburgh, Pennsylvania, November.**
83. Ghose, A. 2006. Information Uncertainty in Electronic Markets: An Empirical Analysis of Trade Patterns and Adverse Selection. ***Proceedings of ZEW Workshop on ICT*****, Germany, October.**
84. Ghose, A. and K. Huang. 2006. Personalized Pricing and Quality Design. ***INFORMS Marketing Science Conference*****, Pittsburgh, Pennsylvania, June.**
85. Forman, C., A. Ghose and A. Goldfarb. 2006. The Impact of Location on Consumer Purchases in Electronic Markets. ***INFORMS Marketing Science Conference*****, Pittsburgh, Pennsylvania, June.**
86. Ghose, A. and B. Gu. 2006. Measuring Menu Costs of Online Retailers. ***INFORMS Marketing Science Conference*****, Pittsburgh, Pennsylvania, June.**
87. Forman, C., A. Ghose and A. Goldfarb. 2006. The Impact of Location on Consumer Purchases in Electronic Markets. ***Conference on Operational Excellence in Retailing***. **Wharton School, June.**
88. The Dimensions of Reputation in Electronic Markets. ***Decision and Information Sciences Workshop***, **University of Florida, February.**
89. Ghose, A., P. Ipeirotis and A. Sundararajan. 2006. The Dimensions of Reputation in Electronic Markets. ***Statistical Challenges in E-Commerce Research (SCECR)*****, University of Minnesota, May.**
90. Forman, C., A. Ghose and A. Goldfarb. 2006. The Impact of Location on Consumer Purchases in Electronic Markets. ***Statistical Challenges in E-Commerce Research (SCECR)*****, University of Minnesota, May.**
91. Ghose, A. and B. Gu. 2006. Is Consumer Demand Kinked? Estimating Menu Costs and Search Costs in Electronic Markets. ***Statistical Challenges in E-Commerce Research (SCECR)*****, University of Minnesota, May.**
92. Ghose, A. and K. Huang. 2006. Personalized Pricing and Quality Design. ***International Industrial Organization Conference*****, Boston, Massachusetts, April.**
93. Ghose, A. and K. Huang. 2005. Personalized Pricing and Quality Design. ***Workshop on Information Systems and Economics (WISE 2005)*****, UC Irvine, California, December.**
94. Ghose, A. and K. Huang. 2005. A Competitive Analysis of Personalized Pricing and Quality Customization. ***Proceedings of the Workshop on CRM*****, New York University, November.**
95. Ghose, A. and A. Sundararajan. 2005. Pricing and Product Line Strategies for Software: Theory and Evidence. ***INFORMS Annual Meeting*****, San Francisco, California, November.**
96. Ghose, A., M. Smith, and R. Telang. 2005. Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Implications. ***INFORMS Annual Meeting*****, San Francisco, California, November.**
97. Ghose, A. 2005. Used Good Trade and Adverse Selection: A Cross-Country Comparison of Electronic Secondary Markets. ***INFORMS Annual Meeting*****, San Francisco, California, November.**
98. Ghose, A. and A. Sundararajan. 2005. Pricing and Product Line Strategies for Software: Theory and Evidence. ***Statistical Challenges in E-Commerce Research (SCECR)*****, University of Maryland, College Park, May.**
99. Ghose, A., M. Smith, and R. Telang. 2005. Product Cannibalization and Welfare Implications. ***Statistical Challenges in E-Commerce Research (SCECR)*****, University of Maryland, College Park, May.**
100. Gal-Or, E., and A. Ghose. 2005. The Economic Consequences of Sharing Security Information. ***International Industrial Organization Conference*****, Atlanta, Georgia, April.**
101. Ghose, A., M. Smith, and R. Telang. 2005. Internet Exchanges for Used Books: Welfare Implications and Policy Issues. ***International Industrial Organization Conference*****, Atlanta, Georgia, April.**

102. Ghose, A., R. Telang and R. Krishnan. 2004. Impact of Electronic Secondary Markets on Information Goods Suppliers. ***Workshop on Information Systems and Economics (WISE 2004)*****, College Park, Maryland, December.**
103. Ghose, A., M. Smith, and R. Telang. 2004. Internet Exchanges for Used Books: An Empirical Analysis of Welfare Implications and Policy Issues. ***INFORMS Annual Meeting*****, Denver, Colorado, October.**
104. Ghose, A., M. Smith, and R. Telang. 2004. Internet Exchanges for Used Books: An Empirical Analysis of Welfare Implications and Policy Issues. ***MISRC/CRITO Symposium on the Digital Divide*****, Minneapolis, Minnesota, August.**
105. Ghose, A., T. Mukhopadhyay, and U. Rajan. 2003. Strategic Benefits of Internet Referral Services. ***International Conference on Electronic Commerce (ICEC 2003)*****, Pittsburgh, October.**
106. Ghose, A., R. Telang and R. Krishnan. 2003. Durable Goods Competition in Secondary Electronic Markets. ***INFORMS Marketing Science Conference*****, College Park, University of Maryland, June.**
107. Ghose, A., T. Mukhopadhyay, and U. Rajan. 2002. Strategic Benefits of Internet Referral Services. ***Workshop on Information Systems and Economics (WISE 2002)*****, Barcelona, Spain, December.**
108. Ghose, A., V. Choudhary, T. Mukhopadhyay, and U. Rajan. 2001. Dynamic Pricing on the Internet ***Workshop on Information Systems and Economics (WISE 2001)*****, New Orleans.**

RESEARCH GRANTS AND AWARDS

2019 MSI Grant for "The Effect of Voice AI on Consumer Purchase and Search Behavior," (with Chenshuo Sun, June Shi and Xiao Liu), $8000.
2019 MSI Grant for "Demand Effects of the Internet-of-Things Channel: Evidence from an Online Retailer," (with Vilma Todri and Panos Adamopolous), $9000.
2018 MSI Grant for "Using Artificial Intelligence to Automate Online-Offline Data Merger for Integrated Marketing," (with Chenshuo Sun and Xiao Liu), $6500.
2016 NSF Grant for "Towards Building a Living Lab for mHealth Analytical and Behavioral Research using Internet of Things", (with B. Li), $230,000.
2015 Adobe Faculty Research Award for "Combining Machine Learning with Randomized Field Experiments to Improve Mobile Advertising," (with B. Li) $ 50,000.
2015 NET Institute Grant for "Towards Digital Attribution," (with V. Todri), $3000.
2014 Wharton Customer Analytics Institute Award (with V. Todri, P. Adamapolous and P.V. Singh)
2014 Kauffman Grant for "Crowd funding Dynamics and its Impact on Entrepreneurial Landscape Empirical Analysis using Big Data," (with G. Burtch and S. Wattal), $30,000.
2013 Google Faculty Research Award for "Mobile Analytics in the New Mobile Economy," $66,500.
2012 Marketing Science Institute Grant for "Apps and Advertising in the Mobile Economy," $15,000.
2012 SEI-Wharton Future of Advertising Grant for "Innovative Approaches to Measuring Advertising Effectiveness," with (S. Han), $6000.
2012 Institute on Asian Consumer Insights (ACI) Grant for "Mobile Ad Effectiveness and App Adoption in Asian Markets," $30,000.
2012 Google Faculty Research Award for "Designing Ranking Systems for Product Search Engines," (With P. Ipeirotis), $60,000.
2012 NET Institute Grant for "Impact of Internet Intermediaries on Spread of STDs," (with J. Chan), $7000.
2012 NYU Abu Dhabi Institute Seed Grant (with V. Dhar, N. Memon, H. Nissenbaum and R. Karri). Research and Education Program," (co-PI with R. Karri, N. Menon, H. Nissenbaum, and R. Zimmerman), $2.9 mn.
2010 MSI-Wharton Interactive Media Initiative (WIMI) Grant for "Modeling Consumer Behavior in Social Media: Analyzing the Role of Geographical Location and Multichannel Usage in

Microblogging Platforms," (with S. Han), $ 10,000.

2010 Wharton Interactive Media Initiative (WIMI) Grant for "Modeling and Examining the Interdependence between Search and Display Advertising," (with A. Goldfarb and S. Bae), $5000.

2010 Google-WPP Marketing Research Award for "Modeling The Dynamics Of Consumer Behavior In Mobile Advertising And Mobile Social Networks," $ 75,000.

2009 NSF Federal Cyberservice SFS Grant for "ASPIRE: An SFS Program for Interdisciplinary Research and Education'' (co-PI with N. Menon, H. Nissenbaum, R. Karri, and R Zimmerman), $ 2.12 million.

2009 NYU Stern Center for Japan-US Business and Economics Studies Grant for "The Economic Value of User-Generated Multimedia Content: A Study of the Mobile Media Market in South Korea," $ 10,000.

2009 NET Institute Summer Grant for "A Structural Model of User Learning and Dynamics in Mobile Media Content," (with S. Han).

2009 MSI-Wharton Interactive Media Initiative (WIMI) Grant for "The Economic Impact of User-Generated Content: Combining Text mining with Demand Estimation in the Hotel Industry," (with P. Ipeirotis), $ 6,500.

2009 MSI-Wharton Interactive Media Initiative Grant for "User Content Generation and Usage in Digital Media," (with S. Han), $ 6,500.

2009 NYU-Poly Research Grant for "The Economics of User-Generated Content in Online Social Media," (with V. Dhar and K. Ross), $ 73,500.

2008 NET Institute Summer Grant for "Impact of Product Attributes and Geography in Search Engine Advertising"

2007 Marketing Science Institute Grant for "An Empirical Analysis of Search Engine Advertising," (with S. Yang), $ 10,000.

2007 NET Institute Summer Grant for "An Empirical Analysis of Sponsored Search in Online Advertising," (with S. Yang).

2007 NET Institute Summer Grant for "Using Text Analytics to Estimate the Economic Value of Online Product Reviews: An Empirical Analysis,"(with P. Ipeirotis).

2007 Microsoft Virtual Earth Award for "Local Search for Hotels and Restaurants using Econometrics, Spatial Data, and Image Classification," (with P. Ipeirotis), $ 35,000.

2007 NSF CAREER Award, "Identifying and Measuring the Economic Value of Information on the Internet," IIS-0643847, $ 498,500.

2006 NYU Research Challenge Fund for "Consumer Use of Electronic Markets: An Empirical Analysis of New and Used Good Markets," $ 10, 500.

2006 Microsoft Live Labs Award for "Combining Econometric and Text Mining Approaches for Measuring the Effect of Online Information Exchanges," (with P. Ipeirotis) $ 37,500.

2006 NET Institute Summer Grant for "Electronic commerce and Local Competition," (with C. Forman and A. Goldfarb).

2006 NET Institute Summer Grant for "Search Costs and Menu Costs in Electronic Markets: Theory and Evidence," (with B. Gu).

2005 NET Institute Summer Grant for "Used Good Trade and Adverse Selection: A Cross-Country Comparison of Electronic Secondary Markets," $10,500.

2005 NET Institute Summer Grant for "Pricing and Product Line Strategies for Consumer Software," (with A. Sundararajan).

2003 Finalist, Third Annual e-BRC Doctoral Support Award Competition, 2003

INVITED PRESENTATIONS, PLENARY TALKS, AND KEYNOTES

1. May 2022. Keynote Speech, Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, Workshop on Human-AI Interaction, American University.
2. April 2022: Keynote Speech, Monetizing Smartphone Data for Improving Business and Society, AIS India Chapter.
3. April 2022: Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment. Seminar, Northwestern University, Kellogg.
4. April 2022: Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment. Seminar, Annual Marketing Camp, Rice University.
5. February 2022. Monetizing Academic Research: Doing Research That Matters, IIT Kharagpur, India.
6. January 2022. Monetizing Smartphone Data for Improving Business and Society, IIM Calcutta, India.
7. December 2021. Keynote Speech. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment. 13th Annual Behavioral Operations Management Conference, China.
8. August 2021. Keynote Speech. Monetizing Smart Phone Data for Improving Business and Society. National University of Singapore Global Research Forum on Computational Social Science.
9. June 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, Webinar, CVS-Aetna Keynote.
10. April 2021**.** Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, Webinar, IIM Udaipur.
11. February 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, Webinar, Dartmouth College.
12. February 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Digital Leadership Series, Webinar, Boston University.
13. January 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Webinar, Webinar, University of Georgia.
14. November 2020. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Webinar, University of British Columbia.
15. November 2020. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Webinar, University of Washington.
16. October 2020. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Webinar, Harvard Business School.
17. July 2020. Mobile Targeting Using Customer Trajectory Patterns, Webinar, IIM Ahmedabad.
18. May 2020. Technology in the Post Covid World, TEDX Gateway Webinar, TED.
19. May 2020. Mobile Targeting Using Customer Trajectory Patterns, Webinar, Virtual Digital Economy Seminar.
20. May 2020. Trading Privacy for the Greater Social Good: How Did America React During COVID-19. Carlson School MIS Online Seminar.
21. May 2020. Using AI, Tech and Data Science to Combat Health Pandemics, NetElixir Expert Seris Webinar.
22. May 2020. Using AI, Tech and Data Science to Combat Health Pandemics, YPO Philippines-Asia Webinar Event.

23. April 2020. Using AI, Tech and Data Science to Combat Health Pandemics, NYU Stern Covid 19 Webinar Series.
24. December 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. AI Summit.
25. November 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Bengal Chamber of Commerce.
26. September 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Salesforce Executive Summit.
27. September 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. NetElixir X=Experience Conference.
28. August 2019. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. MBA Launch Summit. NYU Stern School.
29. July 2019 Keynote Speech. Digital Marketing Analytics. Big Data and Business Analytics Conference, Harbin, China.
30. June 2019 Keynote Speech. Winning in Omni-Channel Retail. Future of Retail Conference, Montreal.
31. May 2019 Plenary Speech. Legal Applications of Digital Marketing, Harvard Law School, Boston.
32. March 2019 Keynote Speech. Winning in Omni-Channel Retail. Aldar Group, Abu Dhabi, UAE.
33. March 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Big Data and Business Analytics Conference, Lagos, Nigeria.
34. February 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. CEO Summit Latin America, Miami.
35. February 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Jack List, Osaka, Japan.
36. February 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Deloitte Consulting Conference, Tokyo, Japan.
37. January 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Japanese Marketing Association, Tokyo, Japan.
38. October 2018 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. MM Innovate, Mobile Marketing Association, NYC.
39. September 2018 Plenary Speech. Using AI and Blockchain to Monetize the Mobile Economy. MSI Immersion, Boston, September 2018.
40. August 2018 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Melbourne Business Analytics Conference, Melbourne, Australia.
41. July 2018 Keynote Speech. Digital Marketing Analytics. Big Data and Business Analytics Conference, Harbin, China, July 2018.
42. June 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Harvard Club of New York.
43. May 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Peking University's Guanghua School of Management, New York.
44. May 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. ZEEMELT 2018, Mumbai.
45. May 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Yale University, Center for Customer Insights.

46. April 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Beijing, Plug and Play.
47. April 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Peking University, Beijing.
48. April 2018. Using AI and Blockchain to Monetize the Mobile Economy. ZAOJIU Talk, Shanghai.
49. April 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Institute of Internet Industry, Tsinghua University, Beijing.
50. April 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Shanghai National Accounting Institute, Shanghai.
51. March 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Donga Business Review Forum, Seoul, South Korea.
52. January 2018. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Indian School of Management & Entrepreneurship, Mumbai.
53. January 2018. Plenary Panelist. Ethics and Artificial Intelligence. National Retail Federation Conference, New York.
54. December 2017. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Digital Leadership Summit, Seoul.
55. December 2017. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, Tel Aviv University, Israel.
56. December 2017. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Korea Internet Corporation Association, Seoul.
57. November 2017. Fireside Chat. Artificial Intelligence and Education. Leverage Edu, New Delhi.
58. November 2017. Plenary Speech. Artificial Intelligence and the Mobile Economy. Thinkers50 Conference, London.
59. October 2017. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Masters and Business Conference, Singularity University, Poland
60. October 2017. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Ignite Conference, University of Minnesota.
61. September 2017. Plenary Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Behavioral Economics in Action Research, University of Toronto.
62. August 2017. Speech. Using Artificial Intelligence to Unlock the Mobile Economy, London.
63. July 2017. Keynote Speech. Big Data and Business Analytics Summer Conference, Harbin.
64. July 2017. Plenary Speech. TAP: Unlocking the Mobile Economy. Yello Mobile Digital Marketing Group, Seoul.
65. July 2017. Plenary Speech. TAP: Unlocking the Mobile Economy. KP Financial Services Group, Seoul.
66. June 2017. Keynote Speech. TAP: Unlocking the Mobile Economy. Innovation Connect Economy Conference, Singapore.
67. June 2017. Keynote Speech. TAP: Unlocking the Mobile Economy. WPP-J.Walter Thompson Digital Conference, Shanghai.
68. May 2017. Plenary Speech. TAP: Unlocking the Mobile Economy. CKGSB Knowledge Series, NYC.
69. January 2017. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, University of Miami.

70. December 2016. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, Cornell University, Ithaca.
71. November 2016. Keynote Speech. Towards Revolutionizing New Frontiers in Mobile Marketing. CTAM Think, Annual Meeting, New York.
72. September 2016. Plenary Speech. Towards Revolutionizing New Frontiers in Mobile Marketing. Teradata PARTNERS Conference, Atlanta.
73. July 2016. Keynote Speech. Data Analytics in Digital Marketing, Harbin Institute of Technology, China.
74. June 2016. Plenary Speaker. Organization of Economic Cooperation and Development (OECD) Annual Meetings, Paris. Title: "Data and Algorithms".
75. April 2016. Keynote Speech. Revolutionizing Mobile Marketing Using Data Science, Philips Behavioral Analytics Summit, Eindhoven, The Netherlands.
76. April 2016. Keynote Speech. Revolutionizing Mobile Marketing Using Data Science, Latent View Conference, Chicago.
77. February 2016. Plenary Speech. New Frontiers in Mobile Marketing Analytics, Personalizationpalooza, New York.
78. February 2016. Plenary Speech. Towards Revolutionizing New Frontiers in Mobile Marketing Using Data Science, MSI Conference, New York.
79. February 2016. Plenary Speech. Using New Media in Islamic Banking, International Forum on Islamic Finance, Khartoum, Sudan.
80. February 2016. Keynote Speech. A Social Media and Digital Marketing Strategy for Banks, Bank of Khartoum, Sudan.
81. November 2015. Keynote Speech. Business Alliance: IT & Marketing Analytics, Milan.
82. October 2015. Keynote Speech, Towards Revolutionizing New Frontiers in Mobile Marketing Using Data Science, Digital Big Data, Smart Life & Mobile Marketing Analytics, New York.
83. October 2015. Plenary Panelist, Consumer Analytics Using Wearable and Mobile Technologies, Association of Consumer Research Roundtable, New Orleans.
84. October 2015. Keynote Speech. Using Randomized Field Experiments to Measure Mobile Marketing Effectiveness, Unleashing Data Summit: Innovations in Marketing, Research, Insights and Branding, New York.
85. September 2015. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, Yale China India conference, New York.
86. September 2015. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, Georgia State University, Atlanta.
87. September 2015. Plenary Speech. MIXX Canada, Interactive Advertising Bureau of Canada, Toronto.
88. August 2015 Keynote Speech. Crowdfunding in the Digital Economy, NYU Stern MBA Class of 2017, New York.
89. June 2015. Keynote Speech. Harvard Business Review, Latin America Conference, Sao Paulo, Brazil. Title: "Big Data and Analytics."
90. June 2015. Keynote Speech. Data Analytics in Digital Marketing, Harbin Institute of Technology, China.
91. June 2015. Plenary Speaker. Organization of Economic Cooperation and Development (OECD) Annual Meetings, Paris. Title: "The New Production Revolution".

92. June 2015. Invited Speaker. ESSEC Business School. Title: "Randomized Field Experiments in Mobile Marketing."
93. June 2015. Invited Speaker. HEC. Title: "Randomized Field Experiments in Mobile Marketing."
94. May 2015. Invited Speaker. University of Minnesota. Title: "Randomized Field Experiments in Mobile Marketing."
95. May 2015. Invited Speaker. Adobe, San Jose. Title: "Combining Machine Learning With Randomized Field Experiments in Mobile Marketing."
96. May 2015. Invited Speaker. Stanford University. Title: "Randomized Field Experiments in Mobile Marketing."
97. May 2015. Invited Speaker. John Hopkins University. Title: "Randomized Field Experiments in Mobile Marketing."
98. April 2015. Invited Speaker. Rotman School (Marketing), University of Toronto. Title: "Randomized Field Experiments in Mobile Marketing."
99. April 2015. Invited Speaker. KAIST University, Seoul. Title: "Randomized Field and Natural Experiments in Mobile Marketing."
100. February 2015. Invited Speaker. University of British Columbia. Title: "Randomized Field and Natural Experiments in Mobile Marketing."
101. February 2015. Invited Speaker. Arizona State University. Title: "Randomized Field and Natural Experiments in Mobile Marketing."
102. February 2015. Plenary Speech. Big Data Summit, Toronto.
103. December 2014. Keynote Speech. NYCE Day. Title: "Randomized Field Experiments in Mobile Marketing".
104. November 2014. Invited Speaker, David Eccles School of Business (Marketing), University of Utah,Title: "Randomized Field Experiments in Mobile Marketing".
105. June 2014. Keynote Speech. Start-Up Grind, Shanghai. Title: "Big Data=Big Value".
106. June 2014. Keynote Speech. BTO Conference, Milan, Italy. Title: "Leveraging Mobile for Digital Innovation".
107. June 2014. Invited Speaker. Milan, Italy. Title: "Innovations in Mobile Marketing".
108. May 2014. Invited Speaker, Foster School of Business (Marketing), University of Washington, Seattle. Title: "Analyzing the Interdependence between Web and Mobile Advertising: A Randomized Field Experiment".
109. April 2014. Invited Speaker. KAIST University, Seoul. Title: "Randomized Field Experiments in Mobile Marketing."
110. March 2014: Keynote Speech. Workshop on Social & Business Analytics, University of Texas, Austin. Title: "Big Data, Randomized Field Experiments and Mobile Marketing Analytics".
111. December 2013. Keynote Speech. BTO Conference, Milan, Italy. Title: "Leveraging Mobile for Digital Innovation".
112. November 2013. Keynote Speech. Future of Business Event, NYU Stern. Title: "Using Big Data to Leverage The Mobile Consumer."
113. November 2013. Panel Moderator. Stern Graduate Marketing Association, NYU. Title: "Solving the Digital Equation."
114. October 2013. Plenary Speech. eBeverage Conference. Denver. Title: "Big Data and Mobile Analytics.

115. October 2013. Keynote Speech. Data Science and Big Data Initiative, Charlotte. Title: "Using Big Data to Leverage The Mobile Consumer." September 2013. Keynote Speech. NYU Stern Alumni, New York. Title: "Using Big Data to Leverage the Mobile Consumer."
116. September 2013. Plenary Speech. NYC Media Lab Research Summit, New York. Title: "Tapping into Crowd funding."
117. August 2013. Keynote Speech. Digital Summit, Hyderabad. "Mobile Economy and Location-Based Marketing."
118. August 2013. Keynote Speech. MBA Launch Summit. NYU Stern School. Title: "Technology, Innovation, and the Role of Business in Society."
119. August 2013. Keynote Speech. Undergraduate Orientation. NYU Stern School. Title: "Technology, Innovation, and the Role of Business in Society."
120. June 2013. Keynote Speech. E-Metrics Conference, Chicago. Title: "Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy."
121. May 2013. Plenary Panelist. The Economist Innovation Forum Conference, San Francisco. Title: "Mind the Gap: Resolving the Skills Gap in Data Analytics".
122. May 2013. Invited Speaker. Innovative Approaches to Measuring Advertising Effectiveness Conference, Wharton School. Title: "Analyzing the Interdependence Between Web and Mobile Advertising."
123. April 2013. Invited Speaker. ESSEC Business School, (Marketing). Paris. Title: "Apps, Advertising, and Commerce in the New Mobile Economy."
124. April 2013. Invited Speaker. Heinz School, Carnegie Mellon, Pittsburgh. Title: "Apps, Advertising, and Commerce in the New Mobile Economy."
125. March 2013. Invited Speaker. Fudan University, (Marketing). Shanghai. Title: "Ranking Products on Search Engines."
126. February 2013. Invited Speaker. Lerner School of Business, University of Delaware, Newark. Title: "Ranking Products on Search Engines."
127. February 2013. Webinar. International Institute of Business Analysis. Title: "Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy."
128. January 2013. Plenary Speech. Minnesota Big Data Analytics Conference. University of Minnesota, Minneapolis. Title: "Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy."
129. January 2013. Plenary Speech. Advertising and Data Science Congress. NYU Stern. Title: "Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy."
130. January 2013. Invited Speaker. Boston University, Boston. Title: "Ranking Products on Search Engines."
131. December 2012. Invited Speaker. Harvard Business School (Marketing), Boston. Title: "Apps, Advertising, and Commerce in the New Mobile Economy."
132. December 2012. Invited Speaker. Big Data Conference. MIT, Boston. Title: "Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy."
133. December 2012. Invited Speaker. David Eccles School of Business. University of Utah. Title: "Apps, Advertising, and Commerce in the New Mobile Economy."
134. November 2012. Keynote Speech. Big Data and Business Analytics. BTO Conference, Rome, Italy.
135. November 2012. Keynote Speech. Digital Marketing Summit, Indian School of Business. Title: "Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy."
136. October 2012. Plenary Speech. Orange Institute. Title: "Mobile Analytics."

137. October 2012. Invited Speaker. TED lecture series. TEDxNYU. Title: "Mobile Marketing Trends."
138. September 2012. Moderator. NYU Stern Center for Measurable Marketing. Panel on "Measurable Marketing in the Path to Purchase."
139. August 2012. Keynote Speech. Launch 2012. NYU Stern School. Title: "Technology, Innovation, and the Role of Business in Society."
140. May 2012. Plenary Speech. IBC Workshop, Institute of E-Commerce & Digital Markets (LMU) in Munich, Germany. Title: "Social Media and Digital Marketing Trends."
141. May 2012. Invited Speaker. London Business School (Marketing). Title: "London Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines."
142. April 2012. Invited Speaker. Korea University, Seoul. Title: "Apps, Advertising, and Commerce in the New Mobile Economy."
143. April 2012. Invited Speaker. University of Texas at Austin, Austin. Title: "Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines."
144. March 2012. Invited Speaker. Wharton School, Philadelphia. Title: "Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines."
145. March 2012. Keynote Speech. Allianz Group-CIO Conference, Milan, Italy. Title: "Outlook 2013: Social Media and Digital Marketing Trends."
146. March 2012. Plenary Speech. BTO Conference, Milan, Italy. Title: "Social Media and Digital Marketing Trends."
147. March 2012. Invited Speaker. University of Connecticut, Storrs. Title: "Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines."
148. February 2012. Moderator. Carlson School, University of Minnesota. Panel on "Leveraging Social Media for Business."
149. February 2012, Moderator. Stern in Africa Conference, NYU Stern. Panel on "Emerging Industries in Africa."
150. November 2011. Invited Speaker. UCLA (Economics), Los Angeles. Title "Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines."
151. November 2011. Invited Speaker. Michigan State, East Lansing. Title: "Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines."
152. October 2011. Invited Speaker. Harvard Business School, Boston. Title: "Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines."
153. September 2011. Invited Speaker. University of Arizona, Tucson. Title: "Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines."
154. August 2011. Keynote Speech. Launch 2011. NYU Stern School. Title: "Technology, Innovation, and the Role of Business in Society."
155. June 2011. Plenary Panelist. Statistical Challenges in Ecommerce Research (SCECR) conference, Rio De Janeiro, Brazil. Title: "Smart-Everything: Cyber Analytics Platforms and Real-Time Monitoring of the Real World."
156. May 2011. Plenary Panelist. NYU Stern Conference on Measurable Marketing in a Digital World. Title: "Cross Media Effectiveness Measurement."
157. September 2009. Invited Speaker. Internet Economics Conference, Stanford University. Title: "User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning."

158. April 2009. Invited Speaker. Columbia University. Title: "Combining Text mining with Econometrics: Monetization of User-Generated Content and Online Advertising."
159. April 2009. Invited Speaker. Microsoft Research, Boston. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
160. April 2009. Invited Speaker. Heinz College, Carnegie Mellon University. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
161. March 2009. Invited Speaker. Wharton School, University of Pennsylvania. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
162. March 2009. Keynote Speech. Ecommerce and Banking 3.0 Conference, Frankfurt, Germany. Title: User Generated Content and Monetization in the New Economy."
163. March 2009. Invited Speaker. University of Goethe-Frankfurt. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
164. March 2009. Invited Speaker. University of Connecticut. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
165. February 2009. Invited Speaker. University of Calgary. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
166. February 2009. Invited Speaker. Purdue University. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
167. February 2009. Invited Speaker. University of California at Irvine. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
168. November 2008. Invited Speaker. University of Texas at Dallas. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
169. November 2008. Invited Speaker. Polytechnic University of NYU. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
170. November 2008. Invited Speaker. Speaker on the Square Series, NYU. Title: "User Generated Content, Panel on Technology in the Digital Age."
171. October 2008. Invited Speaker. McGill University. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
172. May 2008. Invited Speaker. University of Washington, Seattle. Title "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
173. March 2008. Invited Speaker. IBM Research. Mining User-Generated Content Using Econometrics: A Case Study on Reputation Systems.
174. February 2008. Invited Speaker. Yahoo Research. Mining User-Generated Content Using Econometrics: A Case Study on Reputation Systems.
175. February 2008. Invited Speaker. Marketing Science Institute. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
176. November 2007. Invited Speaker. University of Minnesota, Minneapolis. Title: "The Dimensions of Reputation in Electronic Markets."

177. June 2007. Invited Speaker. City University of Hong Kong. Title: "The Dimensions of Reputation in Electronic Markets."
178. June 2007. Invited Speaker. Hong Kong University of Science and Technology. Title: "The Dimensions of Reputation in Electronic Markets."
179. June 2007. Invited Speaker. Nanyang Business School, Singapore. Title: "The Dimensions of Reputation in Electronic Markets."
180. June 2007. Invited Speaker. Singapore Management University. Title: "The Dimensions of Reputation in Electronic Markets."
181. June 2007. Invited Speaker. National University of Singapore. Title: "The Dimensions of Reputation in Electronic Markets."
182. June 2007. Invited Speaker. Conference on Operational Excellence in Retailing. Harvard University (HBS). Title: "Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Implications."
183. June 2007. Invited Speaker. Triennial Invitational Choice Symposium, Wharton School. Personalized Pricing and Quality Design.
184. February 2007. Invited Speaker. University of Texas at Austin. Title: "Geography and Ecommerce: Measuring Convenience, Selection and Price."
185. January 2007. Invited Speaker. University of Florida. Title: "Geography and Ecommerce: Measuring Convenience, Selection and Price."
186. November 2006. Invited Speaker. Moore School of Business, University of South Carolina. Geography and Ecommerce: Measuring Convenience, Selection, and Price.
187. November 2006. Invited Speaker. Marketing Lunchtime Seminar, NYU Stern School of Business. Title: "Geography and Ecommerce: Measuring Convenience, Selection, and Price."
188. June 2006. Invited Speaker. Conference on Operational Excellence in Retailing. Wharton School. Title: "The Impact of Location on Consumer Purchases in Electronic Markets."
189. April 2006. Invited Speaker. Drexel University. Title: "Personalized Pricing and Quality Design."
190. January 2006. Invited Speaker. Ohio State University. Title: "Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Implications."
191. February 2004: Invited Speaker. University of Southern California. Title: "Impact of Internet Referral Services on the Supply Chain."
192. February 2004. Invited Speaker. University of Arizona. Title: "Impact of Internet Referral Services on the Supply Chain."
193. February 2004. Invited Speaker. University of Maryland at College Park. Title: "Impact of Internet Referral Services on the Supply Chain."

CONFERENCE PRESENTATIONS

1. August 2019. Invited Speaker. Title: AI and Blockchain in Marketing. Emory University Conference, Atlanta.
2. June 2019. Invited Speaker. Title: AI and Blockchain in Omni Channel Marketing. INFORMS Marketing Science Conference, Rome.
3. June 2019. Invited Speaker. Title: AI and Blockchain in Marketing. AMA Seth Annual Marketing Conference, New York.

4. June 2018. Invited Speaker. Title: Using AI and Blockchain in Marketing. INFORMS Marketing Science Conference.
5. October 2014. Invited Speaker, INFORMS Annual Conference, Thought Leader Series. Title: "Randomized Field Experiments in Mobile Marketing."
6. May 2014. Conference Presentation. Crowds 2.0 Conference, NYU Stern School. Title: "Privacy Controls and Anonymity in Crowd funding."
7. November 2013. Conference Presentation. Mapping Mobile Conference, NYU Stern School. Title: "Randomized Field Experiments to Measure ROI of Mobile Advertising and Mobile Coupons".
8. June 2013. Conference Presentation. Marketing Science Conference, Istanbul. Title: "Estimating Cross Platform and Cross Device Synergies Between Web and Mobile Advertising."
9. June 2011. Conference Presentation. Statistical Challenges in ecommerce Research (SCECR) conference, Rio De Janeiro, Brazil. Title: "How is the Mobile Internet Different?"
10. June 2011. Conference Presentation. ZEW Conference, Mannheim. Title: "Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content."
11. June 2010. Conference Presentation. Marketing Science Conference, Cologne. Title: "Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content."
12. June 2010. Conference Presentation. Searle Research Symposium on the Economics and Law of Internet Search, Northwestern University. Title: "Estimating Demand in the Hotel Industry by Mining User- Generated and Crowd-Sourced Content."
13. May 2010. Customer Insights Conference, Yale University. Conference Presentation. Title: "Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content."
14. December 2009. Conference Presentation. Workshop on Information Technology and Systems (WITS), Phoenix. Title: "Towards Designing Ranking Systems for Hotels on Travel Search Engines: Combining Text mining with Demand Estimation in the Hotel Industry."
15. December 2009. Conference Presentation. MSI-WIMI Conference, University of Pennsylvania, Philadelphia. Title: "User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning."
16. August 2009. Conference Presentation. Marketing Dynamics Conference, NYU Stern, August. Title: "User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning."
17. June 2009. Conference Presentation. Marketing Science Conference, University of Michigan, Ann Arbor. Title: "User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning."
18. January 2009. Conference Presentation. The Economics of the Internet and Software, Toulouse. Title: "Modeling and Estimating the Relationship Between Organic and Paid Search Advertising."
19. December 2008. Conference Presentation. International Symposium on Information Systems (ISIS), ISB, Hyderabad. Title: "Modeling and Estimating the Relationship Between Organic and Paid Search Advertising."
20. December 2008. Conference Presentation. International Conference on Information Systems (ICIS), Paris. Market Frictions, Demand Structure and Price Competition in Online Markets.
21. December 2008. Conference Presentation. Workshop on Information Systems and Economics (WISE), Paris. Title: "Modeling and Estimating the Relationship Between Organic and Paid Search Advertising."

22. December 2008. Conference Presentation. Workshop on Information Technology and Systems (WITS), Paris. An Empirical Analysis of Search Engine Advertising: Sponsored and Organic Search in Electronic Markets.
23. November 2008. Conference Presentation. Federal Trade Commission, Washington DC. Title: "Modeling and Estimating the Relationship Between Organic and Paid Search Advertising."
24. October 2008. Conference Presentation. INFORMS Annual Meeting, Washington DC. Title: "The Dimensions of Reputation in Electronic Markets."
25. October 2008. Conference Presentation. INFORMS CIST, Washington DC. Title: "Deriving the Pricing Power of Product Features by Mining User-Generated Reviews."
26. August 2008. Conference Presentation. International Workshop on Data mining and Audience Intelligence for Advertising. ADKDD. Las Vegas. Title: "Comparing Performance Metrics in Organic Search with Sponsored Search Advertising."
27. June 2008. Conference Presentation. Marketing Science Conference, Vancouver. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
28. May 2008. Conference Presentation. International Industrial Organization Conference, Washington DC. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
29. April 2008. Conference Presentation. NET Institute Conference, NYU. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
30. February 2008. Conference Presentation. ACM WSDM Conference, Stanford University. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
31. December 2007. Conference Presentation. International Conference on Information Systems (ICIS) Montreal. Title: "Estimating Menu Costs in Electronic Markets."
32. December 2007. Conference Presentation. Workshop on Information Systems and Economics (WISE), Montreal. Title: "Towards Empirically Modeling Consumer and Firm Behavior in Sponsored Search Advertising."
33. November 2007. Conference Presentation. Conference on Information Systems and Technology (CIST), Seattle. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
34. November 2007. Conference Presentation. INFORMS, Seattle. Title: "Examining the Relationship Between Reviews and Sales: The Role of Reviewer Identify Disclosure in Electronic Markets."
35. August 2007. Conference Presentation. International Conference on Electronic Commerce (ICEC), Minnesota. Title: "Designing Novel Review Ranking Systems: Predicting Usefulness and Impact."
36. August 2007. Conference Presentation. International Conference on Electronic Commerce (ICEC), Minnesota. Title: "An Empirical Analyses of Paid Placement in Online Keyword Advertising."
37. May 2007. Conference Presentation. Statistical Challenges in E-Commerce. Title: "Designing Novel Review Ranking Systems on the Web: Combining Economics with Opinion Mining."
38. April 2007. Conference Presentation. NET Institute Conference, New York University. Title: "Geography and Ecommerce: Measuring Convenience, Selection and Price."
39. January 2007. Conference Presentation. DIMACS Workshop, Rutgers University. Title: "Designing Trusted Ranking Systems for Consumer Reviews: Combining Economics with Opinion Mining."

40. January 2007. Conference Presentation. International Conference on Decision Support Systems (ICDSS), IIM Kolkata, India. Title: "Designing Ranking Systems for Consumer Reviews: The Economic Impact of Customer Sentiment in Electronic Markets."
41. December 2006. Conference Presentation. International Symposium on Information Systems (ISIS), ISB, Hyderabad. Title: "Estimating Menu Costs in Electronic Markets.
42. December 2006. Conference Presentation. International Symposium on Information Systems (ISIS), ISB, Hyderabad. Title: "The Dimensions of Reputation in Electronic Markets."
43. December 2006. Conference Presentation. International Symposium on Information Systems (ISIS), ISB, Hyderabad. Title: "The Impact of Location on Consumer Use of Electronic Markets."
44. December 2006. Conference Presentation. Workshop on Information Technology and Systems (WITS), Milwaukee. Title: "Towards an Understanding of the Impact of Customer Sentiment on Product Sales and Review Quality."
45. December 2006. Conference Presentation. International Conference on Information Systems (ICIS), Milwaukee. Title: "The Impact of Location on Consumer Purchases in Electronic Markets."
46. December 2006. Conference Presentation. Workshop on Information Systems and Economics (WISE), Northwestern University, Evanston. Title: "Search Costs, Demand Structure and Long Tail in Electronic Markets: Theory and Evidence."
47. November 2006. Conference Presentation. INFORMS Annual Meeting, Pittsburgh. Title: "Impact of Internet Referral Services on the Supply Chain."
48. November 2006. Conference Presentation. INFORMS Annual Meeting, Pittsburgh. Title: "Estimating Menu Costs in Electronic Markets."
49. November 2006. Conference Presentation. INFORMS Annual Meeting, Pittsburgh. Title: "The Impact of Location on Consumer Purchases in Electronic Markets."
50. November 2006. Conference Presentation. INFORMS Conference on Information Systems and Technology (CIST), Pittsburgh. Title: "Software Versioning and Quality Degradation? An Exploratory Study of the Evidence."
51. October 2006. Conference Presentation. ZEW Conference on ICT, Mannheim. Title: "Information Uncertainty in Electronic Markets: An Empirical Analysis of Trade Patterns and Adverse Selection."
52. June 2006. Conference Presentation. Workshop on Economics and Information Security (WEIS), Cambridge University. Title: "The Economic Impact of Regulatory Information Disclosure on Information Security Investments, Competition, and Social Welfare."
53. June 2006. Conference Presentation. INFORMS Marketing Science Conference, Pittsburgh. Title: "Personalized Pricing and Quality Design."
54. May 2006. Conference Presentation. Statistical Challenges in E-Commerce Research, University of Minnesota. Title: "The Dimensions of Reputation in Electronic Markets."
55. April 2006. Conference Presentation. International Industrial Organization Conference, Boston. Title: "Personalized Pricing and Quality Design."
56. April 2006. Conference Presentation. NET Institute Conference, New York University. Title: "Used Good Trade and Adverse Selection in Electronic Secondary Markets."
57. March 2006. Conference Presentation. Impact of Internet Referral Services on the Supply Chain. ISR Workshop, University of Michigan at Ann Arbor.
58. February 2006. Conference Presentation. University of Florida. Title: "The Dimensions of Reputation in Electronic Markets."

59. December 2005. Conference Presentation. International Conference on Information Systems (ICIS), Las Vegas. Title: "Software Versioning and Quality Degradation? An Exploratory Study of the Evidence."
60. December 2005. Conference Presentation. Workshop on Information Systems and Economics (WISE), UC Irvine, California. Title: "Personalized Pricing and Quality Design."
61. November 2005. Conference Presentation. Workshop on CRM, New York University. Title: "A Competitive Analysis of Personalized Pricing and Quality Customization."
62. November 2005. Conference Presentation. INFORMS Annual Meeting, San Francisco, California. Title: "Pricing and Product Line Strategies for Software: Theory and Evidence."
63. November 2005. Conference Presentation. INFORMS Annual Meeting, San Francisco, California. Title: "Used Good Trade and Adverse Selection: A Cross-Country Comparison of Electronic Secondary Markets.
64. June 2005. Conference Presentation. Workshop on Economics of Information Security, Harvard University, Boston. Title: "Pricing Security Software."
65. May 2005. Conference Presentation. Statistical Challenges in ecommerce Research. Maryland. Title: "Pricing and Product Line Strategies for Consumer Software: Evidence from Amazon."
66. April 2005. Conference Presentation. International Industrial Organization Conference. Atlanta. Title: "The Economic Incentives for Sharing Security Information."
67. January 2005. Conference Presentation. Hawaiian International Conference on System Sciences. Hawaii. Title: "Effect of Electronic Secondary Markets on the Supply Chain."
68. December 2004. Conference Presentation. Workshop on Information Systems and Economics (WISE). University of Maryland at College Park. Title: "Impact of Secondary Electronic Markets on Information Goods Suppliers."
69. December 2003. Conference Presentation. International Conference on Information Systems (ICIS). Seattle, WA. Title: "Durable Goods Competition in the Presence of Secondary E-Marketplaces."
70. December 2003. Conference Presentation. International Conference on Information Systems (ICIS). Seattle, WA. Title: "Internet Exchanges for Used Books: An Empirical Investigation into Welfare Implications and Policy Issues."
71. October 2003. Conference Presentation. International Conference on E-Commerce (ICEC). Pittsburgh, PA. Title: "Strategic Benefits of Internet Referral Services."
72. October 2003. Conference Presentation. Conference on Information Systems and Technology (CIST), Atlanta, GA. Title: "Dynamic Pricing: A Strategic Advantage for Electronic Retailers."
73. June 2003. Conference Presentation. Workshop on Economics of Information Security. University of Maryland at College Park. Title: "The Economic Incentives for Sharing Security Information."
74. December 2002. Conference Presentation. Workshop on Information Systems and Economics (WISE). Barcelona, Spain. Title: "Impact of Internet Referral Services on the Supply Chain."
75. December 2002. Conference Presentation. International Conference on Information Systems (ICIS). Barcelona, Spain. Title: "Dynamic Pricing: A Strategic Advantage for Internet Retailers".
76. November 2002. Conference Presentation. INFORMS Conference on Information Systems and Technology (CIST), San Jose. Title: "Impact of Referral Services on Channel Profits: Competition between Manufacturers and Info mediaries."
77. February 2004. Invited Speaker. University of California at Irvine. Title: "Impact of Internet Referral Services on the Supply Chain."
78. February 2004. Invited Speaker. Tulane University. Title: "Impact of Internet Referral Services on The Supply Chain."

79. February 2004. Invited Speaker. University of Connecticut. Title: "Impact of Internet Referral Services on the Supply Chain."
80. February 2004. Invited Speaker. New York University. Title: "Impact of Internet Referral Services on the Supply Chain."
81. January 2004. Invited Speaker. University of Alberta. Title: "Impact of Internet Referral Services on The Supply Chain."
82. May 2011. Plenary Panelist. India World Conference, New York. Title "India's IT Industry: The End of the Beginning".
83. May 2011. Invited Speaker. Rising Star Speaker Series, Case Western University. Cleveland. Title: "Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.
84. May 2011. Invited Speaker. MIT (Sloan Marketing), Boston. Title: "Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content."
85. April 2011. Invited Speaker. Columbia University (GSB Marketing), New York. Title: "Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content."
86. April 2011. Invited Speaker. Seoul National University, Seoul. Title: "Designing Ranking Systems For Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content."
87. January 2011. Invited Speaker. MSI Young Scholar's Conference, Utah. Title: "Search and Social Media in the Digital Economy: A Research Agenda."
88. December 2010. Plenary Panelist. Workshop on Information Systems and Economics, Phoenix, Arizona. Title: "Whither WISE."
89. October 2010. Invited Speaker. University of Maryland, College Park. Title: "Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd Sourced Content".
90. October 2010. Invited Speaker. Distinguished Speaker Series, Georgia Tech, Atlanta, October. Title: Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd- Sourced Content.
91. September 2010. Plenary Panelist. Workshop on Interdisciplinary Studies in Information Security and Privacy, Abu Dhabi. Title: "Privacy Issues in Social Media and Ecommerce."
92. September 2010. Invited Speaker. Harvard University (Economics), Boston. Title: "Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content."
93. September 2010. Invited Speaker. George Mason University, Washington DC. Title: "Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content."
94. July 2010. Invited Speaker. NBER IT Economics & Productivity Workshop, Boston. Title: "Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content."
95. July 2010. Invited Speaker. Stanford Institute of Theoretical Economics (SITE), Stanford University. Title: "A Dynamic Structural Model of User Learning in Mobile Media Content."
96. June 2010. Invited Speaker. Workshop on Digital Business Models, Paris. Title: "Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content."
97. June 2010, Plenary Speech. L2 Mobile Commerce Clinic at NYU Stern. Title: "Mobile Trends, Consumers, and Social Media."

98. April 2010. Invited Speaker. Temple University. Title: "Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content.
99. February 2010. Invited Tutorial. Carlson School. University of Minnesota. Title: "Structural Econometric Modeling: Static and Dynamic Models".
100. February 2010. Invited Speaker. University of Minnesota. Title: "Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content."
101. September 2009. Invited Speaker. Internet Economics Conference, Stanford University. Title: "User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning."
102. April 2009. Invited Speaker. Columbia University. Title: "Combining Text mining with Econometrics: Monetization of User-Generated Content and Online Advertising."
103. April 2009. Invited Speaker. Microsoft Research, Boston. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.
104. November 2008. Invited Speaker. Speaker on the Square Series, NYU. Title: "User Generated Content, Panel on Technology in the Digital Age."
105. October 2008. Invited Speaker. McGill University. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
106. May 2008. Invited Speaker. University of Washington, Seattle. Title "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
107. March 2008. Invited Speaker. IBM Research. Mining User-Generated Content Using Econometrics: A Case Study on Reputation Systems.
108. February 2008. Invited Speaker. Yahoo Research. Mining User-Generated Content Using Econometrics: A Case Study on Reputation Systems.
109. February 2008. Invited Speaker. Marketing Science Institute. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
110. November 2007. Invited Speaker. University of Minnesota, Minneapolis. Title: "The Dimensions Of Reputation in Electronic Markets."
111. June 2007. Invited Speaker. City University of Hong Kong. Title: "The Dimensions of Reputation In Electronic Markets."
112. June 2007. Invited Speaker. Hong Kong University of Science and Technology. Title: "The Dimensions of Reputation in Electronic Markets."
113. June 2007. Invited Speaker. Nanyang Business School, Singapore. Title: "The Dimensions of Reputation in Electronic Markets."
114. June 2007. Invited Speaker. Singapore Management University. Title: "The Dimensions of Reputation in Electronic Markets."
115. June 2007. Invited Speaker. National University of Singapore. Title: "The Dimensions of Reputation in Electronic Markets."
116. June 2007. Invited Speaker. Conference on Operational Excellence in Retailing. Harvard University (HBS). Title: "Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Implications."
117. June 2007. Invited Speaker. Triennial Invitational Choice Symposium, Wharton School. Personalized Pricing and Quality Design.
118. February 2007. Invited Speaker. University of Texas at Austin. Title: "Geography and Ecommerce: Measuring Convenience, Selection and Price."

119. January 2007. Invited Speaker. University of Florida. Title: "Geography and Ecommerce: Measuring Convenience, Selection and Price."
120. November 2006. Invited Speaker. Moore School of Business, University of South Carolina. Geography and Ecommerce: Measuring Convenience, Selection, and Price.
121. November 2006. Invited Speaker. Marketing Lunchtime Seminar, NYU Stern School of Business. Title: "Geography and Ecommerce: Measuring Convenience, Selection, and Price."
122. June 2006. Invited Speaker. Conference on Operational Excellence in Retailing. Wharton School. Title: "The Impact of Location on Consumer Purchases in Electronic Markets."
123. April 2006. Invited Speaker. Drexel University. Title: "Personalized Pricing and Quality Design.
124. January 2006. Invited Speaker. Ohio State University. Title: "Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Implications."
125. February 2004: Invited Speaker. University of Southern California. Title: "Impact of Internet Referral Services on the Supply Chain."
126. February 2004. Invited Speaker. University of Arizona. Title: "Impact of Internet Referral Services on the Supply Chain."
127. February 2004. Invited Speaker. University of Maryland at College Park. Title: "Impact of Internet Referral Services on the Supply Chain."
128. February 2004. Invited Speaker. University of California at Irvine. Title: "Impact of Internet Referral Services on the Supply Chain."
129. February 2004. Invited Speaker. Tulane University. Title: "Impact of Internet Referral Services on the Supply Chain."
130. February 2004. Invited Speaker. University of Connecticut. Title: "Impact of Internet Referral Services on the Supply Chain."
131. February 2004. Invited Speaker. New York University. Title: "Impact of Internet Referral Services on the Supply Chain."
132. January 2004. Invited Speaker. University of Alberta. Title: "Impact of Internet Referral Services on the Supply Chain."

TEACHING

- EMBA: Digital Marketing Analytics, NYU Spring 2022. (Instructor Rating: 4.4/5)
- MBA: Digital Marketing Analytics, NYU Winter 2022. (Instructor Rating: 4.7/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2021. (Instructor Rating: 4.75/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2021. (Instructor Rating: 4.9/5)
- MBA: Digital Marketing Analytics, NYU Winter 2021. (Instructor Rating: 4.5/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2020. (Instructor Rating: 4.7/5)
- MBA: Digital Marketing Analytics, NYU Summer 2020. (Instructor Rating: 4.5/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2020. (Instructor Rating: 4.6/5)
- MBA: Digital Marketing Analytics, NYU Fall 2019. (Instructor Rating: 4.8/5)
- MBA: Digital Marketing Analytics, NYU Summer 2019. (Instructor Rating: 4.8/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2019. (Instructor Rating: 4.8/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2019. (Instructor Rating: 4.8/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2018. (Instructor Rating: 4.7/5)
- MBA: Digital Marketing Analytics, NYU Summer 2018. (Instructor Rating: 4.6/5)

- EMBA: Digital Marketing Analytics, NYU Spring 2018. (Instructor Rating: 4.8/5)
- MBA: Digital Marketing Analytics, NYU Fall 2017. (Instructor Rating: 6.8/7)
- MBA: Digital Marketing Analytics, NYU Summer 2017. (Instructor Rating: 6.7/7)
- MSBA: Digital Marketing Analytics, NYU Summer 2017. (Instructor Rating: 6.6/7)
- EMBA: Digital Marketing Analytics, NYU Spring 2017. (Instructor Rating: 6.8/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2016. (Instructor Rating: 6.7/7)
- MBA: Digital Marketing Analytics, NYU Fall 2016. (Instructor Rating: 6.8/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Spring 2016. (Instructor Rating: 6.5/7)
- MBA: Digital Marketing Analytics, NYU Summer 2016. (Instructor Rating: 6.6/7)
- MSBA: Digital Marketing Analytics, NYU Summer 2016. (Instructor Rating: 6.4/7)
- EMBA: Digital Marketing Analytics, NYU Spring 2016. (Instructor Rating: 6.6/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2015. (Instructor Rating: 6.7/7)
- MBA: Digital Marketing Analytics, NYU Summer 2015. (Instructor Rating: 6.6/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Spring 2015. (Instructor Rating: 6.5/7)
- TRIUM MBA: Social Media & Digital Marketing Analytics, NYU Fall 2015. (Instructor Rating: 4.5/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2015. (Instructor Rating: 6.6/7)
- EMBA: Social Media and Digital Marketing Analytics, NYU Spring 2015. (Instructor Rating: 6.4/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2014. (Instructor Rating: 6.8/7)
- TRIUM MBA: Social Media & Digital Marketing Analytics, NYU Fall 2014. (Instructor Rating: 4.5/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2014. (Instructor Rating: 6.9/7)
- MBA: Digital Marketing Analytics, NYU Summer 2014. (Instructor Rating: 6.3/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Spring 2014. (Instructor Rating: 6.9/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Fall 2013. (Instructor Rating: 6.7/7)
- EMBA: Social Media and Digital Marketing Analytics, NYU Spring 2014. (Instructor Rating: 6.85/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2013. (Instructor Rating: 6.7/7)
- MSBA: Social Media and Digital Marketing Analytics, NYU Fall 2013. (Instructor Rating: 6.8/7)
- TRIUM MBA: Social Media & Digital Marketing Analytics, NYU Fall 2013. (Instructor Rating: 3.9/5)
- MBA: Social Media and Digital Marketing Analytics, NYU Summer 2013. (Instructor Rating: 6.5/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Spring 2013. (Instructor Rating: 6.0/7)
- MBA: Social Media and Digital Marketing Analytics, NYU Fall 2012. (Instructor Rating: 6.0/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2012. (Instructor Rating: 6.2/7)
- UG: IT in Business & Society**:** UG Core, NYU Fall 2010. (Instructor Ratings: 6.5/7, 6.6/7)
- UG: Electronic Commerce and Social Media**:** NYU Fall 2009. (Instructor Rating: 6.0/7)
- UG: IT in Business & Society**:** UG Core, NYU Fall 2008. (Instructor Ratings: 6.6/7, 6.7/7)
- UG: Electronic Commerce**:** UG Elective, NYU Fall 2008. (Instructor Rating: 6.6/7)
- UG: IT in Business & Society**:** UG Core, NYU Fall 2007. (Instructor Ratings: 6.6/7, 6.7/7)
- UG: Electronic Commerce**:** UG Elective, NYU Fall 2007. (Instructor Rating: 6.8/7)
- UG: IT in Business & Society**:** UG Core, NYU Fall 2006. (Instructor Ratings: 6.8/7, 7/7)
- UG: Electronic Commerce**:** UG Elective, NYU Fall 2006. (Instructor Rating: 6.7/7)
- UG: IT in Business & Society**:** UG Core, NYU Fall 2005. (Instructor Ratings: 6.6/7, 6.8/7, 6.6/7)
- UG: IT in Business & Society**:** UG Core, NYU, Fall 2004. (Instructor Ratings: 6.2/7, 6.3/7)
- UG: MIS, CMU, Summer 2003. (Instructor Rating: 5/5).

PROFESSIONAL SERVICE (JOURNALS)

- **Department Editor –** *Management Science* (July 2020 –)
- **Senior Editor –** *Information Systems Research* (September 2012 – December 2020)
- **Associate Editor** – *Management Science* (Jan 2009 – June 2020)
- **Associate Editor** – *Management Science* Special Issue on Business Analytics (August 2012)
- **Associate Editor (Ad Hoc)** – *Management Science* (2008 – 2009)
- **Associate Editor –** *Information Systems Research* (Jan 2009 –December 2012)
- **Associate Editor (Ad Hoc)** – *MIS Quarterly* (2010 – Present)
- **Associate Editor –** *MIS Quarterly, S*pecial Issue on "Perspectives on Trust in Information Systems*,"* 2009.
- **Editorial Board –** Information Systems Research, Special Issue on "Digital Systems & Competition", 2008.
- **Reviewer –** *American Economic Review, Decision Support Systems, Economic Theory, Electronic Commerce Research and Applications, IEEE Transactions on Knowledge and Data Engineering, International Journal of Electronic Commerce, Information Systems Research, International Journal of Industrial Organization, Journal of Economics and Management Strategy, Journal of Industrial Economics, Journal of Management Information Systems, Management Science (Information Systems), Management Science (Marketing), Marketing Science, Journal of Marketing Research, MIS Quarterly, Operations Research Letters, Production and Operations Management.*
- **Panel Member –** *Hong Kong Research Grants Council. (2014 – 2020)*

PROFESSIONAL SERVICE (CONFERENCES & WORKSHOPS)

- **WISE Co-Chair** – Workshop on Information Systems and Economics (WISE), 2017, Seoul, December.
- **Track co-Chair** – E-Business and Mobile, International Conference on Information Systems (ICIS) 2016, Dublin.
- **Conference Co-Chair** – Workshop on Information Systems and Economics (WISE), 2014, Auckland, December.
- **Track co-Chair** – Economics of Information Systems, International Conference on Information Systems (ICIS) 2012, Orlando.
- **Senior Program Committee** – ACM Electronic Commerce Conference 2012, Spain, June.
- **Senior Program Committee** – ACM Electronic Commerce Conference 2011, San Jose, June.
- **Program Committee** – INFORMS Conference on Information Systems and Technology (CIST) 2012, October.
- **Program Committee** – INFORMS Conference on Information Systems and Technology (CIST) 2010, Austin, November.
- **Program Committee -** The First International Workshop on Opinion Mining for Business Intelligence (OMBI 2010), Toronto, August.
- **Program Committee -** Workshop on Social Media Analytics (SOMA 2010), Washington DC, July
- **Program Committee** – ACM Electronic Commerce Conference 2010, Boston, June

- **Conference Co-Chair** – INFORMS Conference on Information Systems and Technology (CIST), 2009, San Diego, October.
- **Conference Co-Chair** – Workshop on Information Systems and Economics (WISE), 2008, Paris, December.
- **Conference Co-Organizer** – First New York Computer Science and Economics Day (NYCE Day), 2008, September.
- **Steering Committee Member -** Second New York Computer Science and Economics Day (NYCE Day), 2009, November.
- **Conference Co-Chair** – Fourth Symposium on Statistical Challenges in Ecommerce Research (SCECR) 2008, NY, May.
- **Track Chair –** Pacific Asia Conference on Information Systems (PACIS) 2009, India, July (Ecommerce Track).
- **Track Chair –** Pacific Asia Conference on Information Systems (PACIS) 2008, China, July (Economics of Information Systems Track).
- **Associate Editor** – International Conference on Information Systems (ICIS) 2009, Phoenix, December (Economics of Information Systems Track).
- **Associate Editor** – International Conference on Information Systems (ICIS) 2008, Paris, December (Economics of Information Systems Track).
- **Associate Editor**–International Conference on Information Systems (ICIS) 2007, Montreal, December *(Web-Based Information Systems Track).*
- **Associate Editor**–International Conference on Information Systems (ICIS) 2007, Montreal, December *(Economics and Business Value of Information Systems Track).*
- **Program Committee** – ACM Electronic Commerce Conference 2009, Stanford, June.
- **Program Committee** – World Wide Web Conference 2009 (WWW), Spain, May.
- **Program Committee** – World Wide Web Conference 2008 (WWW), Beijing, May *(Social Networks and Web 2.0 Track and Internet Monetization Track)*
- **Program Committee** – Internat*i*onal Conference on Web Search and Data Mining (WSDM) *2008, Stanford University*, February.
- **Program Committee**–Workshop on Interdisciplinary Studies in Security and Privacy, 2008 (WISSP), NYU-Polytechnic, September.
- **Program Committee**–International Conference on Electronic Commerce 2007 (ICEC), Minnesota, August.
- **Program Committee**–Workshop on Economics of Information Security 2007 (WEIS), Pittsburgh, June.
- **Program Committee** – INFORMS Conference on Information Systems and Technology (CIST) 2007, Seattle, November.
- **Program Committee** – ACM Electronic Commerce Conference 2007, San Diego, June.
- **Program Committee**–International Conference on Decision Support Systems 2007, Kolkata, January
- **Program Committee**–International Symposium of Information Systems 2006, Hyderabad, December
- **Associate Editor**–International Conference on Information Systems 2006 (ICIS), Milwaukee, December *(Economics of Information Systems Track).*
- **Associate Editor**–International Conference on Information Systems 2006 (ICIS), Milwaukee, December *(General Track).*

- **Program Committee**–INFORMS Conference on Information Systems and Technology 2006 (CIST), Pittsburgh, November 2006.
- **Program Committee**–INFORMS Conference on Information Systems and Technology 2005 (CIST), San Francisco, November 2005.
- **Session Chair** – CIST 2008, WEIS 2007, June, Pittsburgh, ICDSS 2007, Kolkata, January, INFORMS 2006, (*ISR Sponsored Cluster*), Pittsburgh, November, INFORMS (*IS Economics Cluster*) 2005, San Francisco, November, INFORMS CIST 2005, San Francisco, November.
- **Discussant** – Workshop in Information Systems and Economics 2011 (Shanghai), Workshop in Information Systems and Economics 2010 (St. Louis), Workshop in Information Systems and Economics 2009 (Phoenix), International Industrial Organization Conference 2008 (Washington DC), International Conference on Information Systems 2007(Montreal), ZEW Workshop on ICT 2006 (Germany), Workshop in Information Systems and Economics 2006 (Evanston), Statistical Challenges in Electronic Commerce 2006 (Minneapolis), International Industrial Organization Conference 2006 (Boston), International Industrial Organization Conference 2005 (Atlanta), Workshop in Information Systems and Economics 2005 (Irvine).

UNIVERSITY SERVICE

- NYU Senate Financial Affairs Committee 2020 – Present
- Academic Director, Masters in Business Analytics 2017 – Present
- Capstone Co-Director, Masters in Business Analytics 2016 – Present
- Director, Center for Business Analytics 2015 – 2018
- Co-Director, Center for Business Analytics 2012 – 2015
- IOMS Core Curriculum Review Committee 2017 – 2018
- MBA Core Curriculum Review Committee 2016
- MSBA Curriculum Review Committee, 2015 – 2016
- External Review Committee, OPIM Department, Wharton School, 2015
- IOMS Executive Committee, 2013 – 2018
- Stern Dean's Faculty Advisory Committee, 2012 – Present
- Stern MBA Launch Committee, 2011– 2014
- NYU Stern-Poly Collaboration Taskforce Committee, 2011
- Stern Doctoral Program Review Committee, 2010
- Stern Research Resources Committee, New York University, 2010 –
- Track Director for Interactive Marketing, CeDER, NYU Stern, 2009–2010.
- Panel Judge in India Leadership Exchange Program Competition, 2009.
- AACSB Review Junior Faculty Team, Stern School, 2009.
- IS faculty member, Stern Undergraduate Honors Program, 2006 – 2012.
- Ph.D. Committee, IOMS Department, Stern School, 2005 – 2006, 2009–Present.
- Coordinator, Information Systems Research Seminar series, Stern School, 2005 – 2007.
- Stern School Team India Committee under Dean Kim Corfman, 2008 –2009.
- Panelist on "Life and Lifestyle for Untenured Faculty Members," New Faculty Orientation at Stern School, New York University 2006, 2007, 2008.
- Promotion & Tenure Review Committee, IOMS Department, Stern School, 2006.

- Strategic Planning Meeting, Stern School, 2006.
- Faculty Recruitment Committee, IOMS Department, Stern School, 2005 – 2006.
- Panelist on "Effective Teaching Strategies", New Faculty Orientation at NYU Stern, 2005.
- Doctoral Student Committee, Carnegie Mellon University, 2002–2004.

POST-DOCTORAL STUDENT SUPERVISION

1. Dr. Hilah Levin (Post Doctoral Advisor, NYU, 2019–2020)
2. Dr. Sang-Pil Han (Post Doctoral Advisor, NYU, 2008–2011 (Now Assistant Professor at Arizona State University)
3. Dr. Sung-Hyuk Park (Post Doctoral Advisor, NYU, 2012– 2014) (Now Assistant Professor, KAIST)
4. Dr. Dominik Molitor (Post Doctoral Advisor), NYU, 2015 – 2016 (Now Assistant Professor at Fordham University)

DOCTORAL STUDENT SUPERVISION

1. Chenshuo Sun – 5th year Student, Stern School (Thesis Chair), TOPS Department, (now Assistant Professor at National University of Singapore)
2. Andrew Lee – 5th year student KAIST (Thesis Committee member), (now Assistant Professor at University of Texas at Dallas)
3. Carlos Fernandez – Stern School, IOMS Department (Thesis Committee member), Graduated May 2021 (now Assistant Professor at Hong Kong University of Science and Technology)
4. Prasanna Parasurama – 4th year Student, Stern School, TOPS Department.
5. Peiyan Yu – 3rd year, Stern School, TOPS Department.
6. Rubing Li – 2nd year, Stern School, TOPS Department
7. Eunsol Cho - 2nd year, Stern School, TOPS Department
8. Shunyuan Zhang – Tepper School, Carnegie Mellon University (Thesis Committee member), (Assistant Professor at Harvard Business School).
9. Vilma Todri – Stern School, IOMS Department (Chair), (Assistant Professor at Emory University)
10. Panos Adamopolous - Stern School, IOMS Department (Thesis Committee Member), (Assistant Professor at Emory University)
11. Xuan Ye – Stern School, IOMS Department (Thesis Committee Member), (Assistant Professor at Boston College)
12. Yuqian Xu – Stern School, IOMS Department (Thesis Committee Member), (Assistant Professor at University of Illinois at Urbana Champaign)
13. Jason Chan – Stern School, IOMS Department (Chair), (Assistant Professor at Carlson School, University of Minnesota from Fall 2014)
14. Beibei Li – Stern School, IOMS Department (co-Chair), (Assistant Professor at Carnegie Mellon University since Fall 2012)
15. Gordon Burtch – Fox School of Business, Temple University (co-Advisor), (Assistant Professor at Carlson School, University of Minnesota from Fall 2013)
16. Yan Huang – Heinz College, Carnegie Mellon University (Thesis Committee member), (Assistant Professor at Ross School, University of Michigan from Fall 2013)

17. Ke-Wei Huang – Stern School, IOMS Department (Thesis Committee member), Graduated 2007 (now Assistant Professor at National University of Singapore)
18. Zheyin (Jane) Gu – Stern School, Marketing Department (Thesis Committee member), Graduated 2008 (now Assistant Professor at SUNY Albany)
19. Rong Zheng – Stern School, IOMS Department (Thesis Committee member), Graduated 2009 (now Assistant Professor at Hong Kong University of Science and Technology)
20. Manuel Arriaga – Stern School, IOMS Department (Thesis Committee member), Graduated 2011 (now Assistant Professor at Cambridge University)
21. Nikolay Archak –Stern School, IOMS Department (Thesis Committee member), Graduated 2012 (Six Sigma)
22. Sanghee Bae – Stern School, Marketing Department (Thesis Committee member)
23. Mingdi Xin – Stern School, IOMS Department (Proposal Committee member), Graduated 2009 (now Assistant Professor at University of California at Irvine)
24. Akhmed Umyarov – Stern School, IOMS Department (Proposal Committee member), Graduated 2010 (now Assistant Professor at University of Minnesota)
25. Zubin Jelveh – 6th year Student, NYU Poly
26. Wally Wang – 2nd year Student, Stern School, IOMS Department.

UNDERGRADUATE STUDENT SUPERVISION

1. Sanjana Gupta – Stern School (Undergraduate Honors Thesis Advisor)
2. Prita Kumar – Stern School (Undergraduate Honors Thesis Advisor)
3. Rohan Deshpande – Stern School (Undergraduate Project Advisor)
4. Pratik Mehta – Stern School (Undergraduate Honors Thesis Advisor)
5. Aileen Chua – Stern School (Undergraduate Honors Thesis Advisor)
6. Eliott Finch – Stern School (Undergraduate Honors Thesis Advisor)

PROFESSIONAL MEMBERSHIPS

- **Research Council Member:** Wharton Customer Analytics Institute (2011 – 2017).
- **Faculty Affiliate:** Marketing Science Institute (2008 – Present)
- **Member:** Association of Information Systems (AIS), Information Systems Society (ISS), INFORMS, Marketing Science Society, American Economic Association (AEA).

CONSULTING

Alibaba, Apple, Bank of Khartoum, Berkeley Corporation, CBS, CTBC Taiwan, Dataxu, DFS Group, Facebook, Google, HCL-Hewlett Packard, HR Ratings Mexico, IBM, Lucidity, Marico India, Microsoft, NetCore, NBC Universal, OneVest, Samsung, Snapchat, TD Bank, Tinder, Verizon, Yahoo, ZeroWeb, 1-800-Contacts.

INDUSTRY POSITIONS

2020 – Present	Senior Consultant (Affiliated Expert), Compass Lexecon
2020 – Present	Governing Board of ICISA, Comptroller and Auditor General of India (CAG)
2017 – 2020	Affiliated Scientific Expert, Analysis Group
2014 – 2020	Affiliated Scientific Expert, Cornerstone Research
2017 – 2020	Scientific Expert, Keystone Strategy
2013 – 2017	Chief Data Scientist, 3TI China
2014 – 2018	Advisor, OneVest
2019 – Present	Advisor, NetCore
2020 – Present	Advisor, Trippal
2018 – Present	Advisor, Lucidity
2018 – 2019	Advisor, Adrealm
2018 – Present	Advisor, ZeroWeb
2018 – Present	Advisor, Tamoco
2017 – Present	Advisor, Leverage Edu
2017 – Present	Advisor, Ibus Networks
2017 – Present	Advisor, EywaMedia
2022 – Present	Advisor, Revenue Roll
1999 – 2000	Senior Consultant, IBM.
1998 –1999	Business Development Manager, HCL-Hewlett Packard.
1997	Management Trainee, Glaxo SmithKline Beecham.

SELECTED PRESS COVERAGE & OPINION PIECES

1. ***Vox,*** June 2022
2. ***NBC News***, February 2022
3. ***Los Angeles Times,*** February 2022
4. ***NPR/Marketplace,*** January 2022
5. ***Forbes,*** November 2021
6. **Consumer Reports,** November 2021
7. ***Quartz***, August 2021
8. **CNN,** July 2021
9. ***Quartz***, June 2021
10. ***Quartz***, April 2021
11. ***Campaign Asia,*** March 2021
12. ***Quartz***, March 2021
13. ***Hindusthan Times*** March 2021
14. ***Adweek,*** December 2020
15. ***Marketplace,*** November 2020
16. ***Adweek,*** November 2020
17. ***Business Insider***, October 2020
18. ***Business Insider***, October 2020
19. ***Quartz***, September 2020
20. ***Business Because,*** September 2020
21. ***Quartz***, September 2020
22. ***BBC***, July 2020
23. ***Money Control***, June 2020
24. ***Wall Street Journal***, May 2020
25. ***Yahoo Finance***, April 2020

26. ***LiveMint,*** April 2020
27. ***The Economic Times***, April 2020
28. ***Forbes,*** April 2020
29. ***LiveMint,*** April 2020
30. ***NDTV,*** March 2020
31. ***Ad Exchanger,*** Feb 2020
32. ***Campaign Asia,*** Feb 2020
33. ***Forbes,*** Jan 2020
34. ***Knowledge@Wharton***, December 2019
35. ***Quartz***, December 2019
36. ***Channel Futures,*** December 2019
37. ***Quartz***, December 2019
38. ***Quartz***, November 2019
39. ***The Economic Times,*** July 2019
40. ***CNN***, June 2019
41. ***CNBC,*** May 2019
42. ***Marketplac*e**,** April 2019
43. ***Quartz***, April 2019
44. ***Science Daily,*** March 2019
45. ***CNN***, March 2019
46. ***Quartz,*** February 2019
47. ***CNBC,*** January 2019
48. ***The Quartz***, January 2018
49. ***Forbes,*** December 2018
50. ***Science Daily,*** November 2018
51. ***Market Watch,*** November 2018
52. ***CNN,*** September 2018
53. ***CNBC***, September 2018
54. ***Fox 4KC,*** September 2018
55. ***The Quartz***, September 2018
56. ***Consumer Affairs***, September 2018
57. ***NPR Marketplace,*** September 2018
58. ***The Quartz***, August 2018
59. ***CNBC TV***, June 2018
60. ***NASDAQ TV***, June 2018
61. ***CNBCTV,*** June 2018
62. ***The Wall Street Journal***, June 2018
63. ***AdAge India***, May 2018
64. ***Harvard Business Review***, May 2018
65. ***AdWeek,*** May 2018
66. ***The Economic Times,*** April 2018
67. ***The Quartz***, April 2018
68. ***The Economic Times,*** April 2018
69. ***INC,*** March 2018
70. ***The Quartz,*** March 2018
71. ***The Quartz,*** February 2018
72. ***The Washington Post,*** January 2018
73. ***Voice of America,*** January 2018
74. ***Associated Press,*** January 2018
75. ***The Economic Times***, January 2018
76. ***The Quartz,*** January 2018

77. ***The Entrepreneur,*** December 2017
78. ***US News,*** December 2017
79. ***The Quartz,*** December 2017
80. ***DBR Korea,*** December 2017
81. ***Hankyung Korea,*** December 2017
82. ***MarketWatch,*** November 2017
83. ***mHealthIntelligence,*** November 2017
84. ***The Quartz,*** October 2017
85. ***Engadget,*** September 2017
86. ***NBC News,*** August 2017
87. ***Business Insider,*** August 2017
88. ***The Globe and Mail***, July 2017
89. ***Bloomberg View***, June 2017
90. ***The Economic Times***, June 2017
91. ***MarketWatch***, June 2017
92. ***The Economic Times***, May 2017
93. ***The Quartz,*** May 2017
94. ***CNBC***, April 2017
95. ***ReCode,*** April 2017
96. ***The Economic Times***, April 2017
97. ***Ad Exchanger***, April 2017
98. ***The Quartz,*** March 2017
99. ***NPR Marketplace,*** January 2017
100. ***The Quartz,*** January 2017
101. ***Knowledge at Wharton***, January 2017
102. ***Market Watch,*** December 2016
103. ***The Quartz,*** December 2016
104. ***The Street,*** December 2016
105. ***NBC News,*** November 2016
106. ***Knowledge at Wharton***, November 2016
107. ***WIRED,*** November 2016***San Francisco Chronicle,*** October 2016
108. ***CKGSB Knowledge,*** October 2016
109. ***ABC News,*** October 2016
110. ***WIRED,*** October 2016
111. ***The New York Post,*** September 2016
112. ***NPR Marketplace,*** September 2016
113. ***NPR Marketplace,*** July 2016
114. ***The Quartz,*** July 2016
115. ***The Quartz,*** May 2016
116. ***The Quartz,*** April 2016
117. ***CNBC,*** March 2016
118. ***OZY,*** March 2016
119. ***The Daily Mail,*** February 2016
120. ***OZY,*** February 2016
121. ***Business Because,*** December 2015
122. ***Investors' Business Daily,*** November 2016.
123. ***OZY,*** November 2015
124. ***NDTV,*** September 2015
125. ***The Entrepreneur,*** August 2015
126. ***The Conversation***, August 2015
127. ***Business Because,*** July 2015

128. ***The New York Times,*** June 2015
129. ***Business Because,*** May 2015
130. ***The Economist***, May 2015
131. ***BBC World News***, March 2015
132. ***The Financial Times***, March 2015
133. ***USA Today,*** February 2015
134. ***Washington Post,*** February 2015
135. ***The Economist***, January 2015.
136. ***National Public Radio,*** January 2015.
137. ***Newsweek***, January 2015.
138. ***The Guardian*** January 2015.
139. ***The Toronto Sun,*** January 2015.
140. ***Bloomberg Media,*** January 2015.
141. ***The Economic Times*** January 2015.
142. ***The Business Standard,*** January 2015.
143. ***The Economic Times*** December 2014.
144. ***USA Today,*** December 2014.
145. ***OZ,*** December 2014.
146. ***Bloomberg Media,*** October 2014.
147. ***LA Times,*** October 2014.
148. ***Business Week,*** September 2014.
149. ***The Wall Street Journal,*** September 2014.
150. ***MBAPrograms,*** June 2014
151. ***The Programmatic Mind,*** June 2014.
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1. Deposition of Anindya Ghose, in *Snapchat, Inc.* vs. *Vaporstream* litigation, on behalf of Snapchat and the defendants, Case No. 2:17-cv-220 (June 6, 2018).
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4. Deposition of Anindya Ghose, in *Social Tech* vs. *Apple Inc.* litigation, on behalf of *Apple*, Case No. 3:18-cv-05945-VC (September 18, 2019).
5. Deposition of Anindya Ghose, in In re *Snapchat, Inc*., IPO Securities and Derivative Litigation, on behalf of *Snap, Inc*. and the individual defendants, United States District Court, Central District of California, Case No. 2:17-cv-03679-SVWAGR (December 16, 2019).
6. Trial Testimony of Anindya Ghose, in Marcus Wide of Grant Thornton (British Virgin Islands) Ltd. and Hugh Dickson of Grant Thornton Spst. Services (Cayman) Ltd., as joint liquidators of *Stanford International Bank* vs. *Toronto-Dominion Bank* litigation, on behalf of *TD Bank*, (March 9-10, 2021).
7. Deposition of Anindya Ghose, in *Sean Rad et al.* vs. *IAC/Interactivecorp, Match Group, Inc., And Match Group, LLC* Litigation, on behalf of *Tinder Plaintiffs*, Case No. 654038/2018 (June 7, 2021).
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9. Deposition of Anindya Ghose, in Securities & Exchange Commission (SEC) vs Eric Dalius et al, on behalf of *SEC*, Case No. 2:18-cv-08497-CJC-E (April 18, 2022).

Appendix B

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Other

Conversation with Karin Hennessy, Group Product Manager, Privacy and User Trust at Google, June 3, 2022.